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ABSTRACT

The 24 units that comprise this crop and soil science curriculum guide are not geared to a particular age level and must be adapted to the students for whom they are used. Units 1 through 6 are general units covering topics common to soil science. Units 7 through 24 are units covering topics common to crop production. Each unit includes objectives and competencies, suggested activities for the instructor and students, information sheets, transparency masters, assignment and/or job sheets, answers to assignment sheets, a test, and answers to the test. Units are planned for more than one lesson or class period. Topics covered include elementary study of soils, soil fertility, irrigation, land preparation, soil conservation practices, land judging, introduction to crop science, basic plant processes, plant growth and development, crop and weed identification, insect pests of crops, plant disease identification and control, crop chemicals, seed selection, planting, potato production, small grain production, corn production, forage production, pasture management, rangeland management, specialty crops, crop storage, and crop marketing and exporting. (YLB)

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CROP AND SOIL SCIENCE

A

CURRICULUM GUIDE

FOR

IDAHO

VOCATIONAL AGRICULTURE INSTRUCTORS

VOLUME 1

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Developed and written by:

Richard L. Ledington

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CROP AND SOIL SCIENCE

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USE OF THIS PUBLICATION

Introduction

This material must be taught. It does not replace the teacher, nor the teacher's expertise. The teacher needs to adapt the material to the local area and individual students. The teacher must also provide the necessary motivating techniques to help the students learn the material.

Instructional Units

The "Crop and Soil Science" curriculum guide has 24 units. Units 1 through 6 are general units covering topics common to soil science. Units 7 through 24 are units covering topics common to crop production. These units are not geared to a particular age level and must be adapted to the students they are used for. Each unit includes objectives and competencies, suggested activities for the instructor and students, information sheet, transparency masters, assignment and/or job sheets, answers to assignment sheets, test and answers to test. Units are planned for more than one lesson or class period.

The teacher should carefully study each instructional unit to determine:

A. The appropriateness of the material for the age level

B. The amount of material that can be covered during a class period

C. Additional objectives and/or assignments which could be developed

D. The skills which must be demonstrated

   1. Supplies needed

   2. Equipment needed

   3. Amount of practice needed

   4. Amount of class time needed for demonstrations

E. Supplementary materials, such as pamphlets, filmstrips and slides, that must be ordered

F. Resource people who must be contacted

Objectives and Competencies

Each unit of instruction is based on stated objectives. These objectives state the goals of the unit, thus providing a sense of direction and accomplishment for the student.

The objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the student performances necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which may have been used in this material:

Name

Label
List in writing
List orally
Letter
Record
Repeat
Give

Identify

Select
Mark
Point out
Pick out
Choose
Locate
Match

State a Rule

Calculate

Apply a Rule

Describe

Define
Discuss in writing
Discuss orally
Interpret
Tell how
Tell what
Explain

Order

Arrange
Sequence
List in order
Classify
Divide
Isolate
Sort

Distinguish

Discriminate

Construct

Draw
Make
Build
Design
Formulate
Reproduce
Transcribe
Reduce
Increase
Figure
Conduct
Compare

Demonstrate

Show your work
Show procedure
Perform an experiment
Perform the steps
Operate
Remove
Replace
Turn on/off
(Dis) assemble
(Dis) connect

Objectives and Competencies (continued)

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives which will fit the material to the needs of the students and community. When a teacher adds objectives, he/she should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. Duties of the instructor will vary according to the particular unit. However, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss unit and specific objectives and information sheet; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Information Sheet

The information sheet provides content essential for meeting the cognitive (knowledge) requirements of the unit. The teacher will find that the information sheet serves as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the unit objective.

Students should read the information sheet before the information is discussed in class. Students may take additional notes on the information sheet.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheet. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able to and in most situations should demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and teacher to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for a student to follow if he/she has missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances he/she might reasonably expect from a person who has had this training.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and can help the teacher spot difficulties being encountered by students in their efforts to accomplish the unit objective. Test items for objectives added by the teacher should be constructed and added to the test.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

Care of Materials

The cost of reproduction of this guide prohibits the replacement of these materials. Therefore, please be extremely careful in handling originals. Make the necessary copies of the information sheets, transparencies, assignments and tests and replace originals in the curriculum guide notebook. Take extra care in keeping originals clear for future reproduction.

ELEMENTARY STUDY OF SOILS
UNIT 1

UNIT OBJECTIVE

After completing this unit, the student should be able to select from a list reasons that soils are important. The student should be able to discuss soil formation, physical properties and label layers of a soil profile. This knowledge will be shown by completing assignments sheets, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with soils to the correct definitions.
2. Select from a list reasons that soils are important.
3. Discuss the function of soil as related to plant growth, development, and maintenance.
4. Label a drawing showing the composition of an average soil.
5. Select from a list factors that affect soil formation.
6. Name the four physical properties of soil.
7. Identify soil particles according to size.
8. Discuss methods used to determine soil texture.
9. Identify five kinds of soil structure.
10. Match terms indicating soil depth to their correct descriptions.
11. Match colors of soil with the identifying characteristics of each.
12. Label an illustration showing the layers of a soil profile.
13. Identify on a pH scale the areas of acidity and alkalinity.
14. Discuss the liming of soils to correct soil acidity.
15. Name three classes of alkali soils.
16. Discuss reclamation of alkali soils.

ELEMENTARY STUDY OF SOILS
UNIT 1

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit

      1. Literature

         a. Teaching Soil and Water Conservation, A Classroom and Field Guide, a pamphlet of 12 student activities. Available from: U.S. Department of Agriculture, Soil Conservation Service, no. PA-341

         b. Conserving Soil, 16-page pamphlet including spirit masters and overhead transparencies. Available from: U.S, Department of Agriculture, Soil Conservation Service.

         c. Soils instructional unit available from: Agri-Farm Publications, Inc., 1019 Market Street, Gowrie, Iowa, 50543; approximate cost $19.50, order no. 211. Also available soil class activity packet, approximate cost $8.25, order no. 1108; and soil guide, approximate cost $11.30, order no. 2106.

         d. Experiments in Soil Science, 259 pages, VEP, Cal Poly State University, San Luis Obispo. CA, 93407; approximate cost $10.75, order no. 1-522-820.

         e. Idaho Soils Atlas, 148 pages of Idaho soil series with color photos; available from University Press of Idaho, University of Idaho, Moscow, ID, 83843.

      2. Filmstrips, slideshows, etc.

         a. Soil Components, 34 slides and 22-minute cassette; available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $46.80, order no. D15.

         b. Soil Texture, 44 slides and 34-minute cassette; available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $83.20, order no. D16.

         c. Soil Structure, 22 slides and 28-minute cassette; available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $41.60, order no. D17.

SUGGESTED ACTIVITIES

   d. Soil Moisture, 21 slides and 38-minute cassette; available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $41.60, order no. D18.

   e. Introduction to Soils, 27 slides and cassette; available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $36.40, order no. D14.

   f. Soil and Its Properties, slides and script, available from Ohio Agricultural Education Curriculum Material Service, Room 254, 2120 Fyffe Rd., Ohio State University, Columbus, OH, 43210; approximate cost $16.75, order no. 50085.

   g. Soil Color, 47-frame filmstrip available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland Dr., Urbanna, IL, 61801; approximate cost $7.05, order no. F708.

3. Films

B. Make transparencies

C. Provide students with objective sheet

D. Provide students with information, assignment and job sheets

E. Discuss unit and specific objectives

F. Discuss information and assignment sheets

G. Demonstrate and discuss procedures outlined in job sheets

H. Arrange for field trip to land site for evaluation

I. Give test

J. Reteach if necessary

K. Retest

SUGGESTED ACTIVITIES

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Transparency masters
    1. TM 1--Why soils are important
    2. TM 2--Soil-plant-animal cycle
    3. TM 3--Composition of average soil
    4. TM 4--Soil origins
    5. TM 5--Physical breakdown of rocks
    6. TM 6--The relative sizes of sand, silt and clay particles
    7. TM 7--Soil texture
    8. TM 8--Characteristics of the various soil classes
    9. TM 9--Permeability related to nutrient capacity
    10. TM 10--The texture triangle
    11. TM 11--Soil structure
    12. TM 12--Hard pans effect on soil depth
    13. TM 13--Soil profile
    14. TM 14--pH scale
    15. TM 15--pH scale - relative strength
    16. TM 16--pH scale - familiar products
    17. TM 17--pH scale for soil reaction
    18. TM 18--pH requirements of crops
    19. TM 19--Soil pH governs nutrient release
    20. TM 20--Low pH limits root growth
    21. TM 21--Ion exchange of soil particles

SUGGESTED ACTIVITIES

E. Assignment sheets

   1. AS 1--Using the textural triangle

F. Answers to assignment sheets

G. Job sheets

   1. JS 1--Determining soil textural class by mechanical analysis

   2. JS 2--Determining soil textural class by feel

H. Test

I. Answers to test

III. Unit references:

A. Loreen, C.O., Our Soils: Their Management and Conservation, Olympia, WA, Northwest Vocational Curriculum Management Center, 1975.

B. Agronomy Curriculum Workshop, Ames, Iowa, Iowa State University, Department of Agricultural Education, 1980.

C. Soils Unit for the Plant Science Core Curriculum, Vol. 9, No. 7, Columbia, MO, University of Missouri - Columbia, Instructional Materials Laboratory.

D. Resource Unit on Soils for Core Curriculum, No. 10, Tucson, Arizona, University of Arizona, Department of Agricultural Education, 1970.

E. Crops, Soils, and Fertilizers Resource Manual, Vo-Ed No. 73, Moscow, ID, University of Idaho, Department of Agricutural Education, 1978.

F. Resource Unit on Soils for Core Curriculum, Bozeman, Montana, Montana State University, Agricultural and Industrial Education, 1975.

G. Oklahoma Curriculum Guides, Stillwater, OK, Oklahoma State University and the Oklahoma State Board for Vocational Education.

H. Texas Curriculum Guides, Vocational Instruction Services, Texas State Board for Vocational Education.

I. Knuti, Williams, and Hide, Profitable Soil Management, Englewood Cliffs, NJ, Prentice-Hall, Inc., 3rd Edition, 1979.

J. Western Fertilizer Handbook, 6th Edition, California Fertilizer Association, Interstate Printers and Publishers, Danville, Illinois, 1980.

ELEMENTARY STUDY OF SOILS
UNIT 1

INFORMATION SHEET

I. Terms and definitions

   A. Soil--The mineral and organic matter that supports plant growth on the earth's surface; it is a mixture of particles of rock, organic materials, living organisms, air and water

   B. Mineral matter--General term for the inorganic elements in the soil, i.e., nitrogen, phosphorus, potassium

   C. Organic matter--General term for plant and animal material in or on the soil in all stages of decomposition

   D. Parent material--The rock and other unconsolidated material from which the soil has developed

   E. Soil texture--A name given a textural group based on the relative proportions of the various soil separates (sand, silt, and clay)

   F. Soil structure--The combination or arrangement of soil particles into aggregates

   G. Aggregate--Mass or cluster of soil particles such as a clod, crumb, or granule

   H. Soil depth--Total thickness of a soil from the topsoil to the parent material

   I. Soil color--Indication of the amount of organic matter and moisture of the soil

   J. Soil profile--A vertical cross-section of the soil from the surface through all its horizons

   K. Soil horizon--A layer of soil approximately parallel to the land surface, differing from other layers in color, structure, texture, pH, etc.

   L. Topsoil--The A horizon of the soil profile; dark colored upper layer of soil that may vary from several inches to 2 or more feet thick

   M. Subsoil--The B Horizon of the soil profile; the layer of soil directly beneath the topsoil

   N. Acid soil--Soil with a pH of less than 7.0; for practical purposes, a soil with a pH of less than 6.6

INFORMATION SHEET

O. Alkaline soil--Soil having a pH value of greater than 7.0; for practical purposes, a soil having a pH above 7.3

P. Leaching--Removal of water soluble soil components from the soil by the downward action of water

Q. Reclamation--Restoration to a better or useful state, as of wasteland, desert, alkali etc.

R. Cation--An ion that has lost an electron and has a positive (+) charge, e.g. potassium, calcium and magnesium

(Note: Cations are positively (+) charged and attracted to negative (-) sites on clays and organic matter.)

S. Anion--An ion that has gained an electron and has a negative (-) charge, e.g. nitrogen, phosphorus and sulphur

(Note: Anions are negatively (-) charged and attracted to positive (+) sites.)

T. Exchange capacity--The ability of a soil to absorb ions to the surface of the soil particle

(Note: Cation exchange capacity is most important in agricultural soils. Anion exchange is very low and confined to low pH soils.)

II. Importance of soils (Transparencies #1 and #2)

A. Plants grow in and on soil

B. Plants support animal life

C. Plants and animals support human life

D. World population is rapidly increasing and/or has inadequate nutrition

E. Supply of productive soil is limited

F. Improved soil management could feed more people

III. Function of soil as related to plant growth, development, and maintenance

A. Media for seed germination

B. Media for support of plants

C. Storehouse of plant nutrients

D. Storehouse of water for the plant

INFORMATION SHEET

IV. What is soil composed of (Transparency #3)

- A. Solids--Approximately 50%
    - 1. Mineral matter
    - 2. Organic matter
    - 3. Living organisms
- B. Pore space--Approximately 50%
    - 1. Water
    - 2. Air

V. Factors affecting soil formation

- A. Parent materials (Transparency #4)
    - 1. Residual
        - a. Igneous--Derived from molten materials in the center of the earth's crust (granitic, basaltic)
        - b. Metamorphic--Formed from the pre-existing rocks through the action of extreme heat and pressures (quartzite, schist)
        - c. Sedimentary--Formed from sediments deposited by wind, water, or ice (shale, sandstone, limestone)
    - 2. Transported:
        - a. Wind (loess)
        - b. Water (alluvial)
        - c. Glaciers (glacial drift)
        - d. Gravity (colluvial)
- B. Decomposition by weathering
    - 1. Physical weathering (Transparency #5)
        - a. Wind
        - b. Plants and animals
        - c. Heating and cooling

INFORMATION SHEET

        - d. Freezing and thawing
        - e. Wetting and drying
    - 2. Chemical weathering
        - a. Chemical reactions of water, oxygen, and carbon dioxide
    - 3. Biological weathering
        - a. Micro-organisms secrete a gummy substance which aids in decomposing rocks
- C. Climate
    - 1. Temperature
    - 2. Rainfall
- D. Vegetation and organisms
    - 1. Plant--Lichens, mosses, weeds, grasses, shrubs, trees
    - 2. Animal--Bacteria, fungi, large animals (cattle, horses, etc.) birds, man
- E. Slope and drainage
    - 1. Hillsides
        - a. Thin topsoil due to soil loss by erosion
        - b. Reduced plant growth
        - c. Low organic matter
        - d. Less leaching (due to runoff)
    - 2. Flat lands
        - a. Deeper topsoil
        - b. More vegetation
        - c. High organic matter
        - d. Greater leaching

VI. Physical properties of soil

- A. Soil texture

INFORMATION SHEET

B. Soil structure

C. Soil depth

D. Soil color

VII. Soil particles (Transparency #6, #7, #8, and #9)

A. Sand

1. Diameter--2.00 to 0.05 mm

2. Coarse and gritty

3. When moist, individual grains can be seen

4. Its presence decreases water holding capacity

5. Its presence decreases nutrient holding capacity

B. Silt

1. Diameter--.05 to .002 mm

2. Its presence increases water holding capacity

3. Its presence increases nutrient holding capacity

4. Moderate to high exchange capacity

5. Feels smooth and velvety

C. Clay

1. Diameter--less than .002 mm

2. Its presence increases water holding capacity

3. Its presence increases nutrient holding capacity

4. High to very high exchange capacity

VIII. Methods used to determine soil texture

A. Mechanical analysis (Transparency #10)

1. A mechanical analysis of a soil reports the percentage of each of the soil particles (sand, silt, and clay)

2. Percentages can be applied to the texture triangle to determine the texture of a soil

INFORMATION SHEET

B. Feel method

1. Texture is determined by moistening the soil and rubbing between thumb and fingers

   a. The wet sample is worked into a ball and placed between thumb and index finger; the thumb is pushed gradually forward in an attempt to form the soil into a ribbon (clayey soil)

   b. If the wet sample will not form a ribbon, evaluate for grittiness (sandy soil)

   c. Evaluate wet sample to determine if it feels velvety and slick, but will not ribbon (silty soil)

2. Descriptions of soils of different texture using the feel method (refer to assignment sheet #2)

   a. Sandy soil

      1) Coarse and gritty

      2) When moist, individual grains can be seen

      3) Called a "light" soil

   b. Silty soil

      1) Feels smooth, flowing when dry

      2) Feels velvety or slick when wet

   c. Clayey soil

      1) Sticky and will form a ribbon when wet

      2) Very hard when dry

      3) Called a "heavy" soil

IX. Types of soil structure (Transparency #11)

A. Granular and crumb (sphere shaped)

1. Ideal for plant growth

B. Blocky (sharp and angular faces)

1. Water storage good

2. Circulation of air and water is poor

INFORMATION SHEET

- C. Platy (flat, horizontal, plate-like)
    - 1. Poor permeability
- D. Prismatic and columnar (column-like)
    - 1. Poor air water relationship

X. Soil depth. (Transparency #12)

- A. Depth refers to the total thickness of a soil from the topsoil to the parent material
- B. Common measurements are:
    - 1. Very deep--over 60" deep
    - 2. Deep--40" to 60" deep
    - 3. Moderately deep--20" to 40" deep
    - 4. Shallow--10" to 20" deep
    - 5. Very shallow--less than 10" deep

  (Note: The productive ability of land largely depends upon its depth of soil. Deep soils are necessary to provide the needed water and nutrients for favorable plant production. Shallow soils have a limited capacity for plant nutrients, water, and root development.)

XI. Soil color.

- A. Color is an important characteristic used in the identification of soil conditions that affect the value of land for agricultural uses
- B. Influenced mainly by organic matter content; benefits of organic matter include:
    - 1. Makes soil porous
    - 2. Supplies nitrogen and other nutrients to the plant
    - 3. Holds water in the soil
    - 4. Reduces leaching
    - 5. Improves soil structure

INFORMATION SHEET

C. Soil colors

1. Dark brown to black--Regarded as the most productive; usually contains a higher organic matter content

2. Red or reddish brown--Usually less fertile than black or dark brown soils; may contain a high iron content

3. Yellow or gray--Usually caused by imperfect drainage

XII. Soil profile (Transparency #13)

A. Components of the soil profile

1. The "A" horizon

2. The "B" horizon

3. The "C" horizon

B. Characteristics of the soil horizons

1. The "A" horizon

a. It includes the upper part of the profile in which life is most active; generally called the topsoil

b. It is the most productive horizon because of its normally high organic matter content and is usually dark colored

c. May be from a few inches to a foot or more deep

d. Lighter in texture than the B or C horizons

e. More likely to have granular structure than the other horizons

2. The "B" horizon

a. Generally called the subsoil

b. Usually low in organic matter, and lighter in color than "A" horizon

c. Usually red or yellowish in color

d. Structure is less desirable than the "A" horizon; it may have a blocky or prismatic structure

e. Frequently heavier texture than "A" horizon

3. The "C" horizon

   a. Generally called parent material

   b. It is the deepest of the three major horizons.

   c. Usually very low in organic matter.

   d. Usually no structure.

XIII. Acidity or alkalinity (Transparencies #14, #15, #16, #17, #18, #19, #20, and #21)

A. The acidity or alkalinity of the soil solution is determined by the relative number of Hydrogen (H^+) ions and hydroxyl (OH^-) ions

B. When a soil solution contains more H^+ ions than OH^- ions, it is acid. When the OH^- ions are more abundant, the solution is alkaline. A neutral solution has an equal amount of H^+ and OH^- ions

C. The acidity or alkalinity is expressed in pH values

D. pH ranges on a scale from 1 to 14

   1. 1 to 7—Acidic soil

   2. 7—Neutral soil

   3. 7-14--Alkaline soil

   (Note: Acidity or alkalinity exert a great influence on the availability of plant nutrients. Plants grow best in pH range 6.0 to 7.5. Poor plant growth is the usual result at pH less than 5.2, or greater than 8.3)

XIV. Liming soils

A. Soil acidity can be corrected by adding lime to the soil. The function of lime is to neutralize the hydrogen (H^+) ions that cause soil acidity

B. Amount of lime to apply depends on

   1. The degree of acidity of the soil

   2. The crops to be grown

   3. The grade or purity of the lime materials

   4. The frequency of application

INFORMATION SHEET

5. Soil texture

6. Soil exchange capacity

XV. Types of alkali soils

A. Saline--Soils in which there has been an accumulation of soluble salts--for example, NaCl (table salt); these are referred to as "white alkali" soils

B. Sodic--Soils in which there has been an accumulation of sodium (Na); sodium affected soils have low permeability to water

(Note: Sodium can solubilize organic matter in the soil. In some instances this happens and the solubilized organic matter is carried to the surface. When dry, this leaves a dark crust on surface of soil. These are called "black alkali" soil.)

C. Saline-sodic--Both salty and sodic affect

(Note: The presence of either salt or sodium greatly affects the potential of a soil for crop production purposes. Their presence affects the water and nutrient uptake by the plant.)

XVI. Reclamation of alkali soils

A. Saline

1. Flood with water and leach out salts

2. Installation of drainage tiles to remove accumulated salts

3. Grow salt tolerant crops

B. Sodic

1. Application of gypsum ($CaSO_4$)

2. Grow sodic tolerant crops

C. Saline-sodic

1. First correct sodic

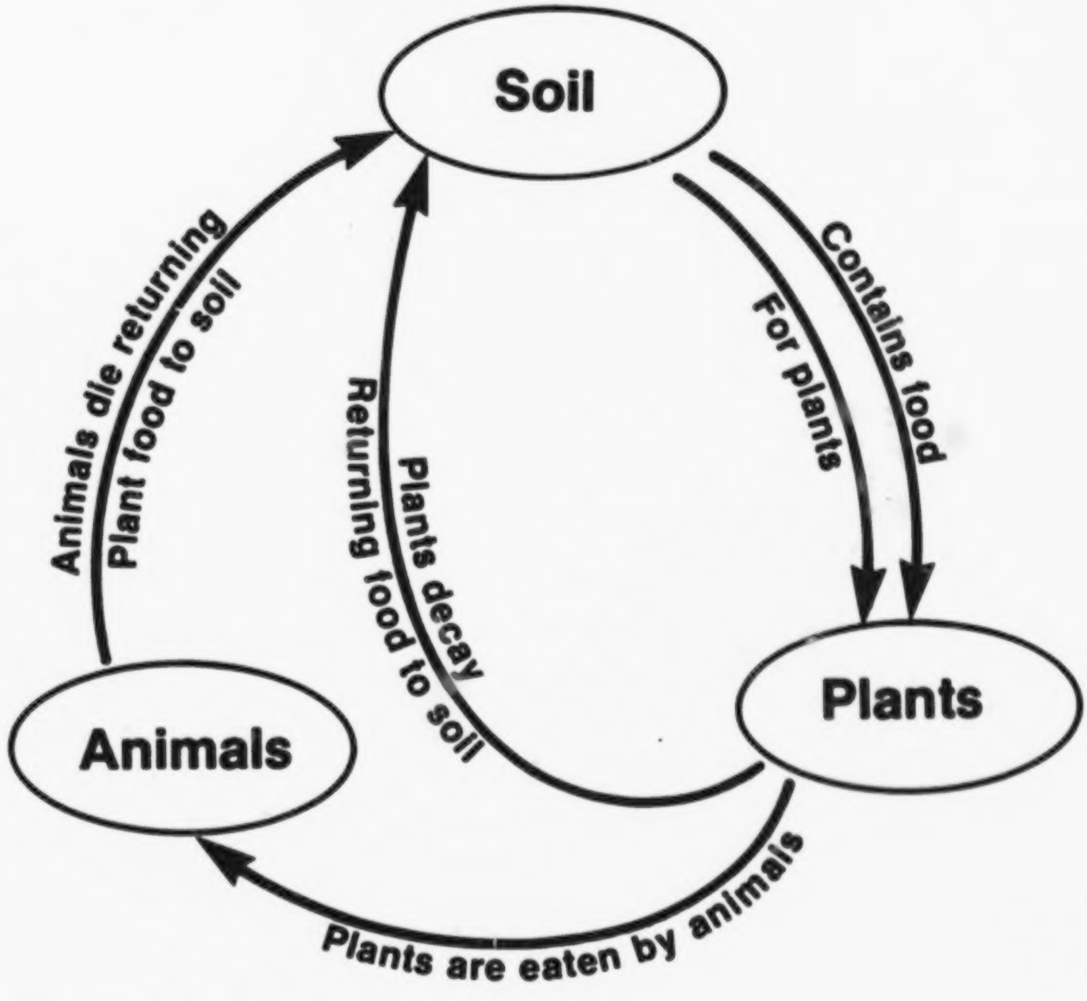
(Note: This should be done first because of the poor permeability affect of sodium on the soil. This makes leaching of the salts difficult.)

2. Then correct salt problem

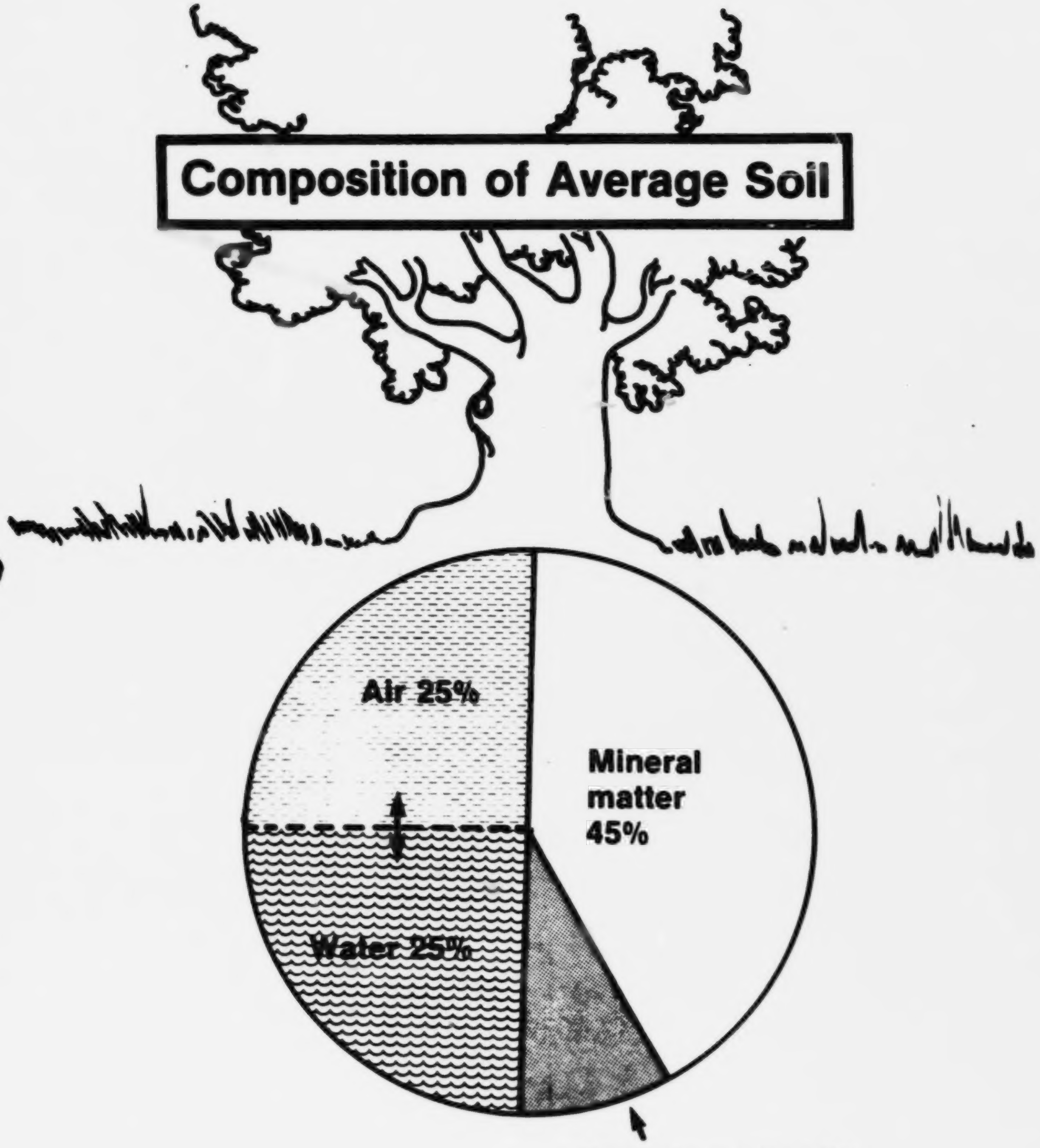
Why Soils Are Important

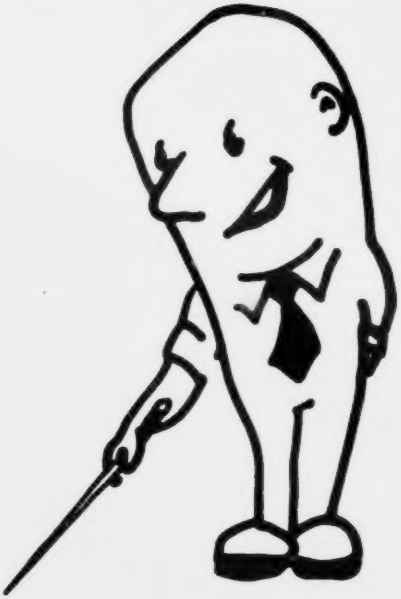
1. Plants grow in and on soil
2. Plants support animal life
3. Plants and animals support human life
4. World population is rapidly increasing and/or has inadequate nutrition
5. Supply of productive soil is limited
6. Improved soil management could feed more people

Soil-Plant-Animal-Cycle


Soil
Plants
Animals
Contains food
For plants
Plants decay
Returning food to soil
Animals die returning
Plant food to soil
Plants are eaten by animals

Composition of Average Soil





Soil Origins

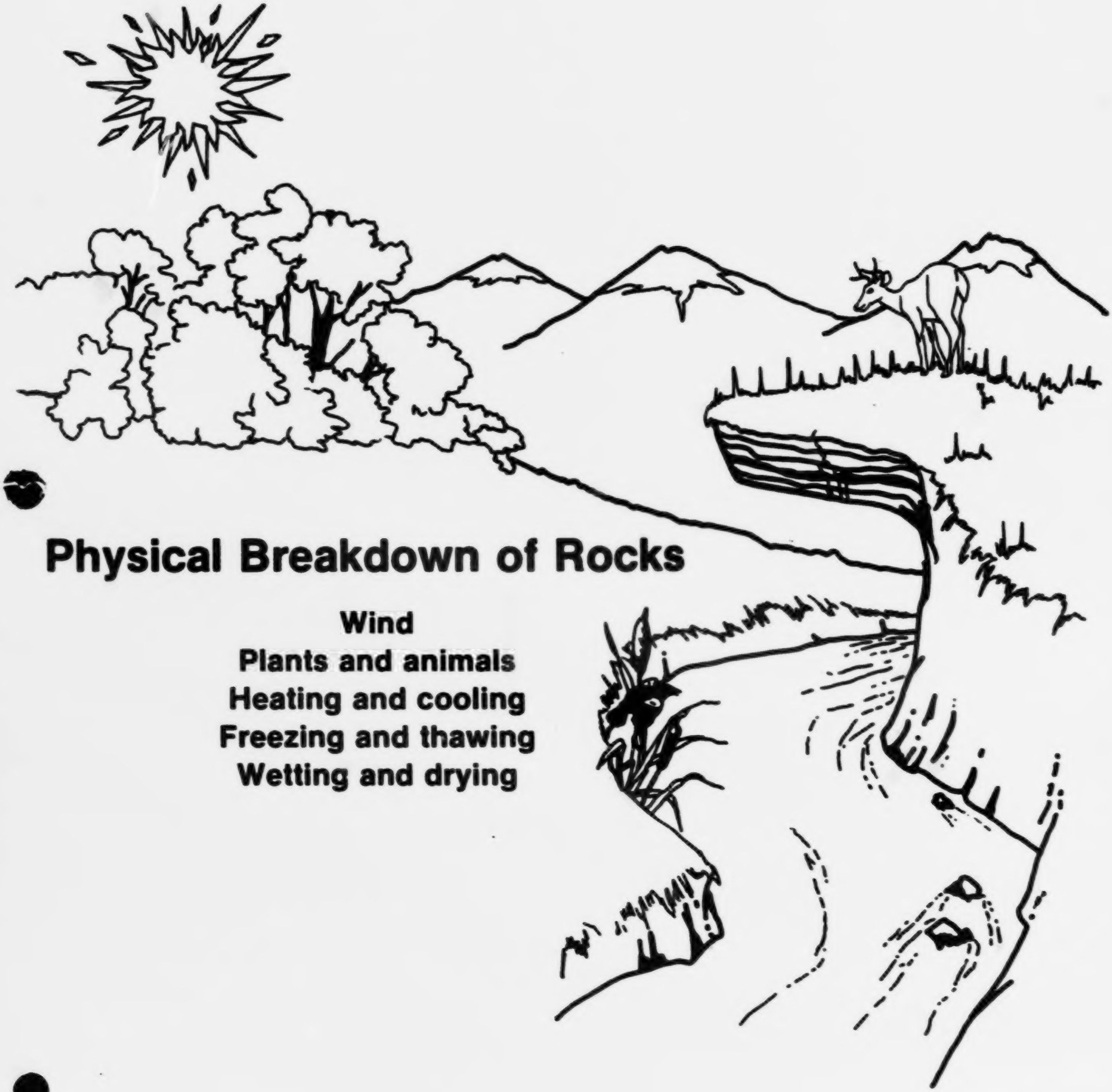
1. Residual

- a. Igneous
- b. Sedimentary } From rock
- c. Metamorphic
- d. Organic - peat (from plant life)

2. Transported

- a. Wind (loess)
- b. Water (alluvial)
- c. Ice (glacial till)

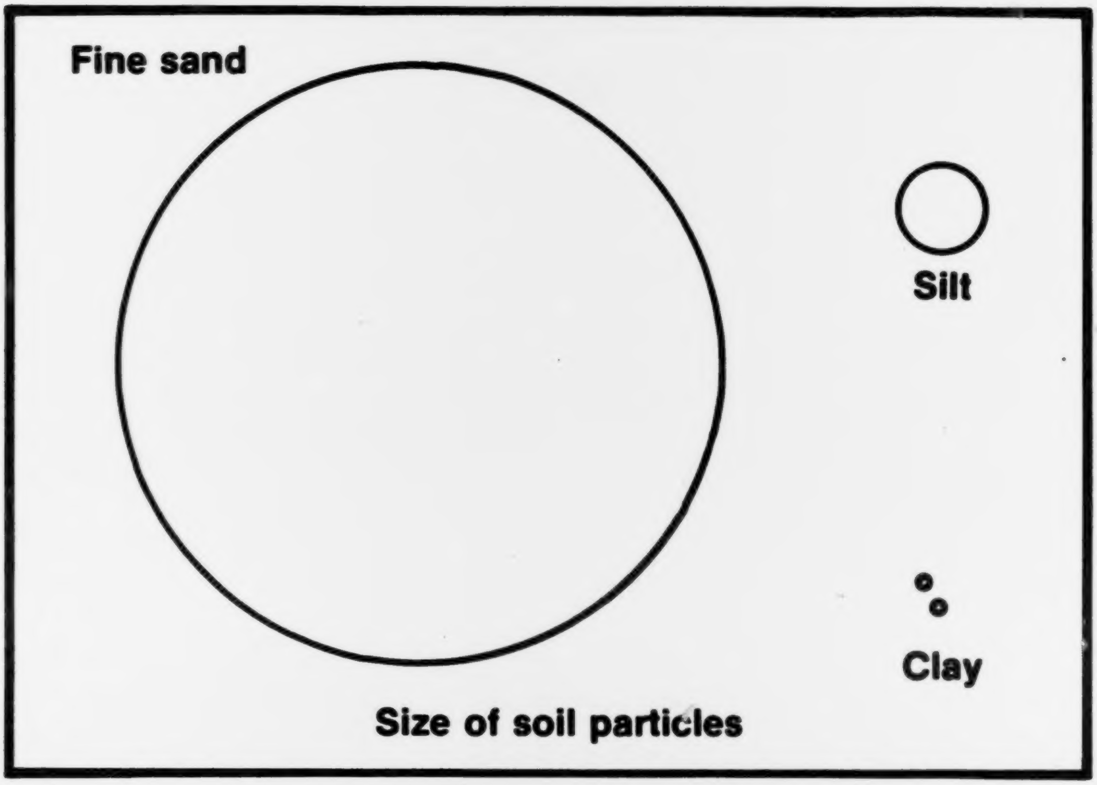
CSS 1 19



Physical Breakdown of Rocks

Wind
Plants and animals
Heating and cooling
Freezing and thawing
Wetting and drying

The Relative Sizes of Sand, Silt, and Clay Particles

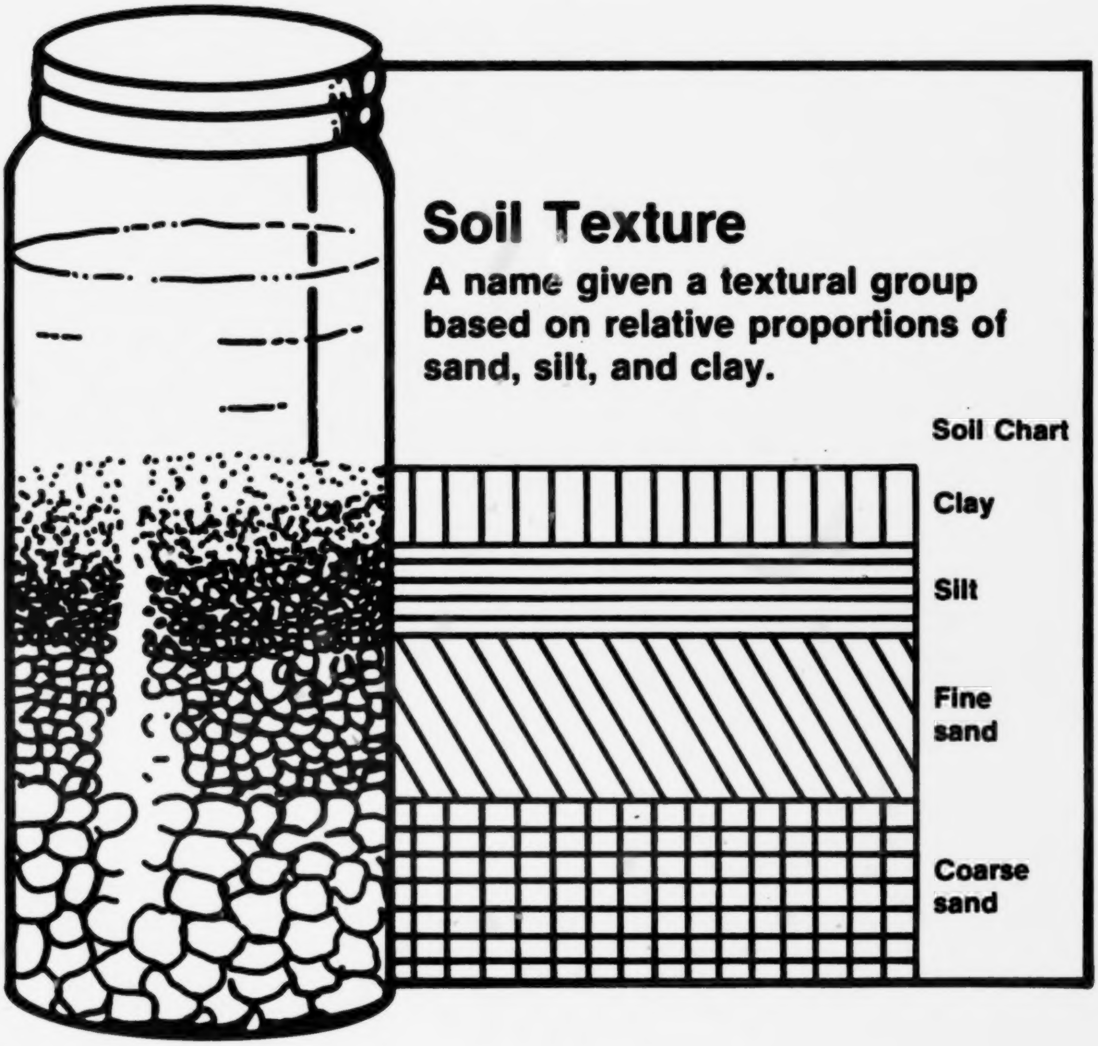


Size of soil particles

Name	Size, diameter in millimeters
Fine gravel	2 - 1
Coarse sand	1.00 - 0.50
Medium sand	0.50 - 0.25
Fine sand	0.25 - 0.10
Very fine sand	0.10 - 0.05
Silt	0.05 - 0.002
Clay	Less than 0.002

Soil Texture

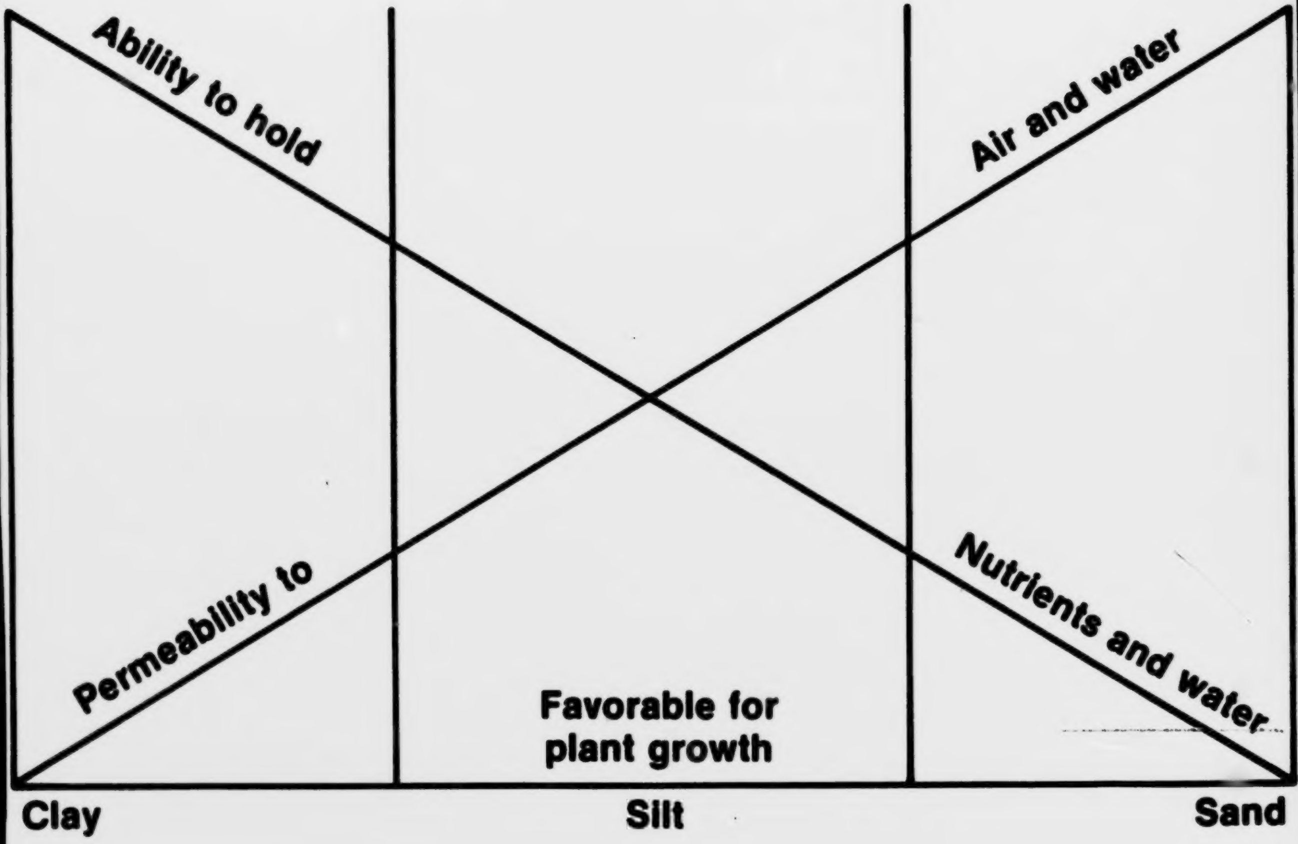
A name given a textural group based on relative proportions of sand, silt, and clay.


Soil Chart
Clay
Silt
Fine sand
Coarse sand

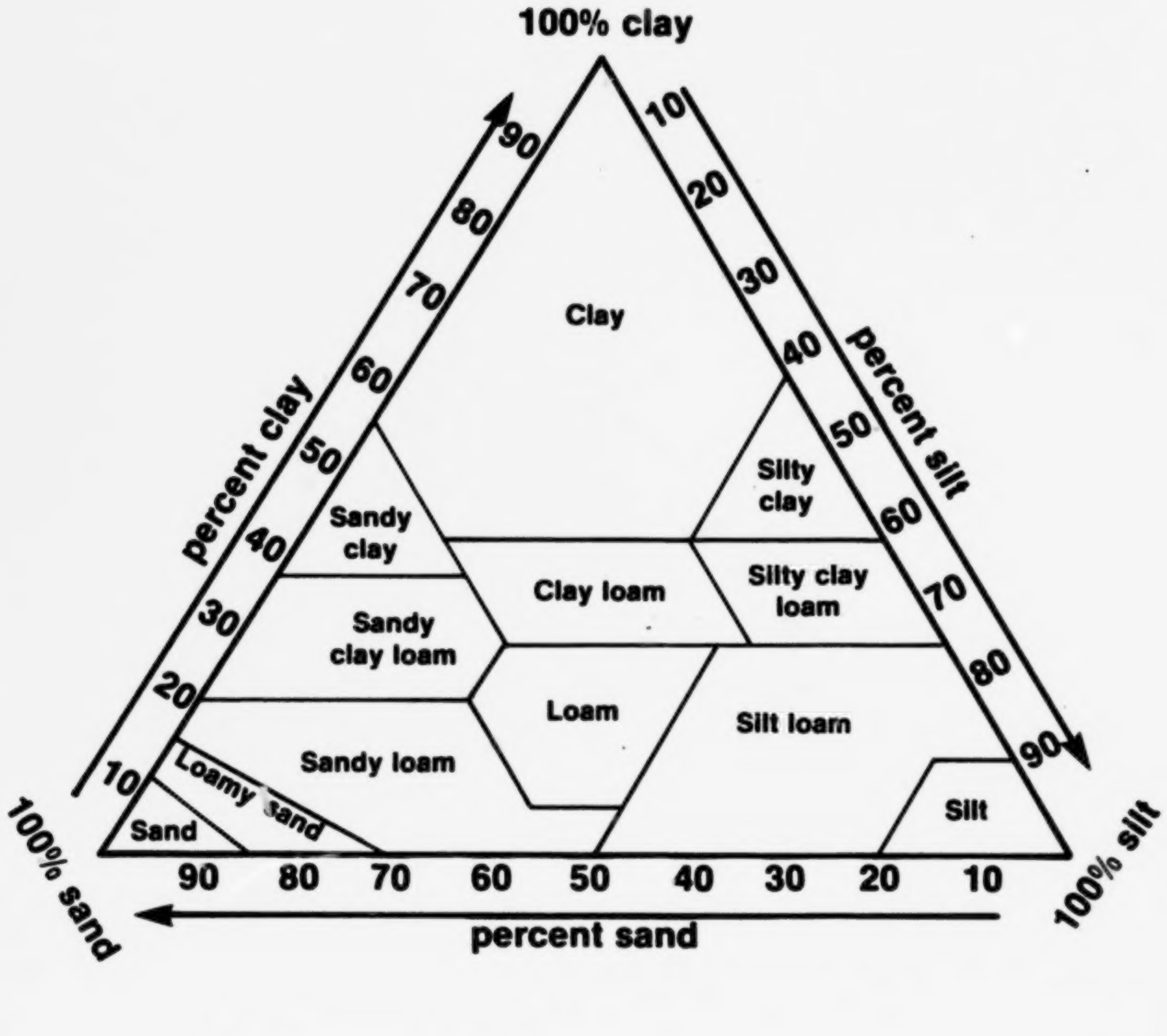
Characteristics of the Various Soil Classes

Characteristics	Sand	Silt	Clay
Looseness	Good	Fair	Poor
Air space	Good	Fair to Good	Poor
Drainage	Good	Fair to Good	Poor
Tendency to form clods	Poor	Fair	Good
Ease of working	Good	Fair to Good	Poor
Moisture holding capacity	Poor	Fair to Good	Good
Fertility	Poor	Fair to Good	Fair to Good

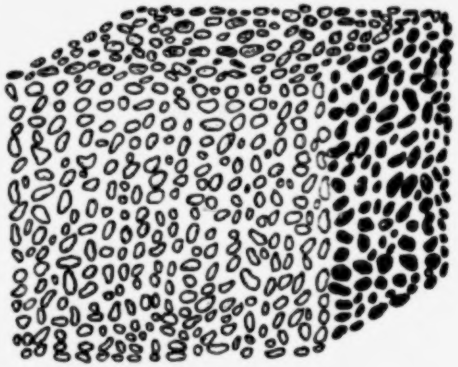
Permeability Related to Nutrient Capacity

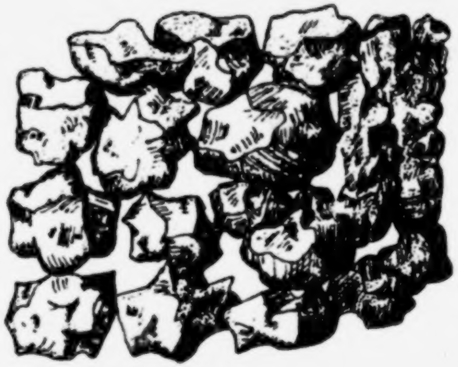

Ability to hold
Air and water
Permeability to
Nutrients and water
Favorable for plant growth
Clay
Silt
Sand

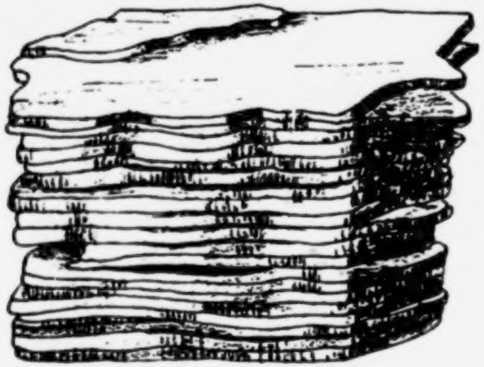
The Texture Triangle

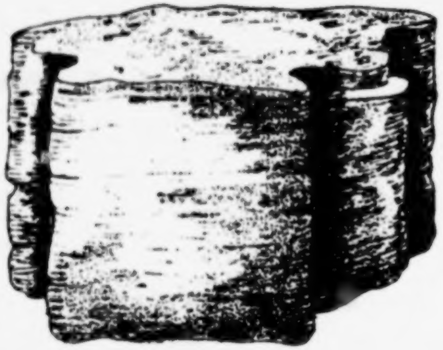

100% clay
percent clay
percent silt
percent sand
100% sand
100% silt
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
90
80
70
60
50
40
30
20
10
Clay
Sandy clay
Silty clay
Clay loam
Silty clay loam
Sandy clay loam
Loam
Silt loam
Sandy loam
Loamy sand
Sand
Silt

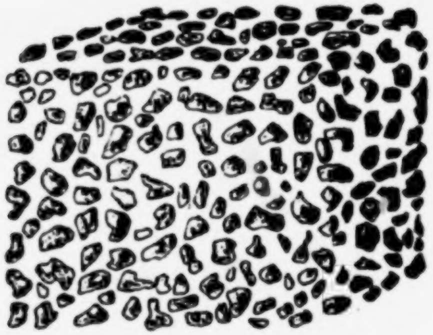
Soil Structure

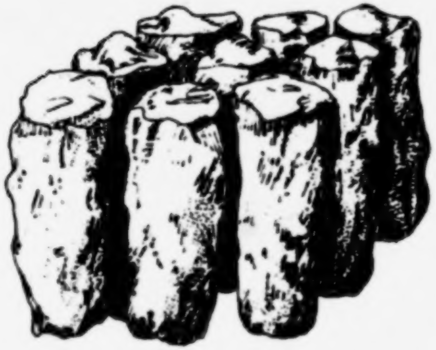

SINGLE GRAIN


BLOCKY


PLATY


MASSIVE


GRANULAR


PRISMATIC

TM #11

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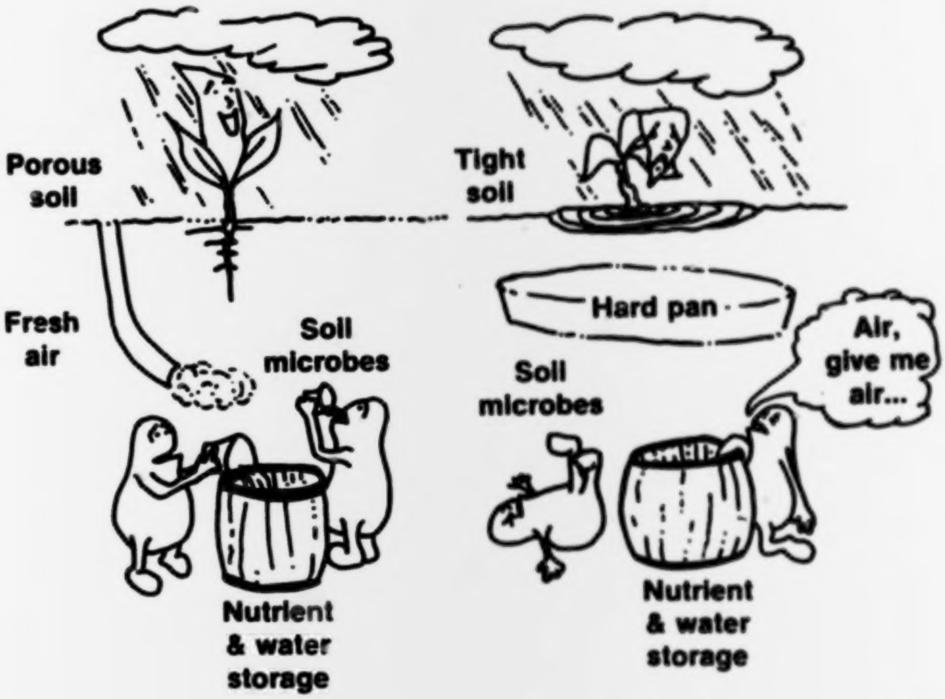
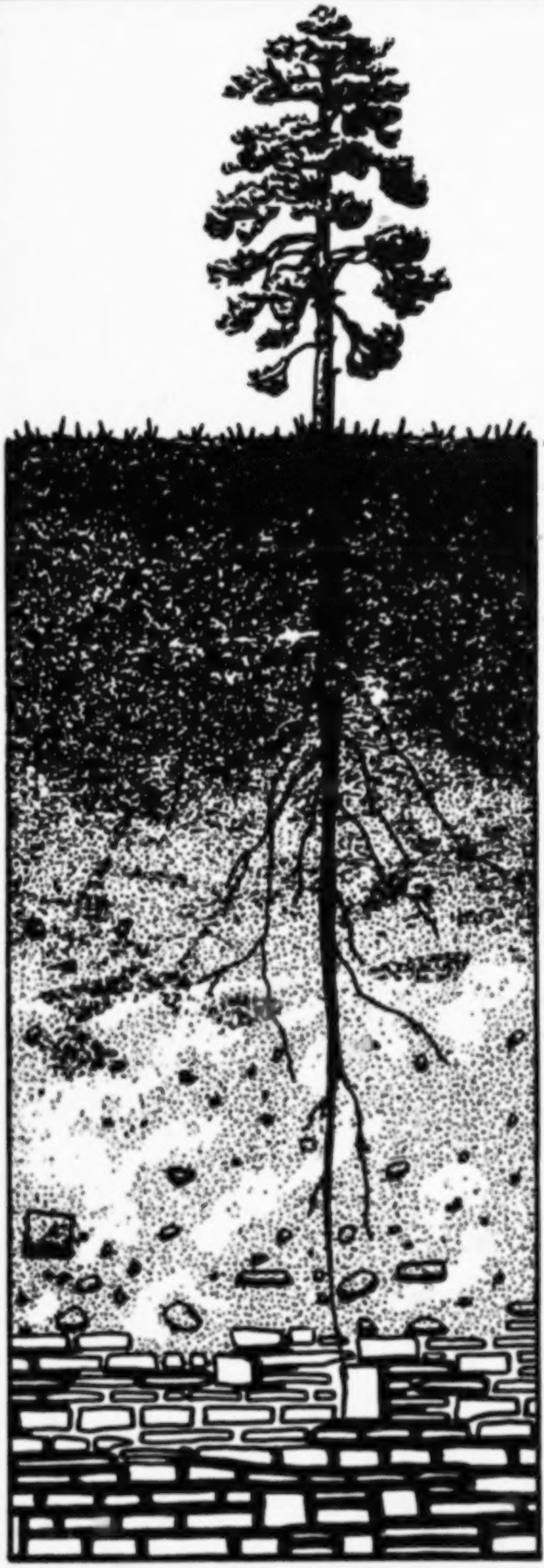
Hard Pans Effect On Soil Depth


Porous soil
Fresh air
Soil microbes
Nutrient & water storage
Tight soil
Hard pan
Soil microbes
Air, give me air...
Nutrient & water storage

A hardened layer of soil is called a hard pan. A hard pan can prevent water, air and nutrients from moving through the soil, and will limit root growth to that part of the soil profile above the restrictive layer.

Soil Profile



01 Undecomposed organic matter

02 Decomposed organic matter

A Horizon

Accumulated decomposed organic matter and mineral materials - usually dark in color

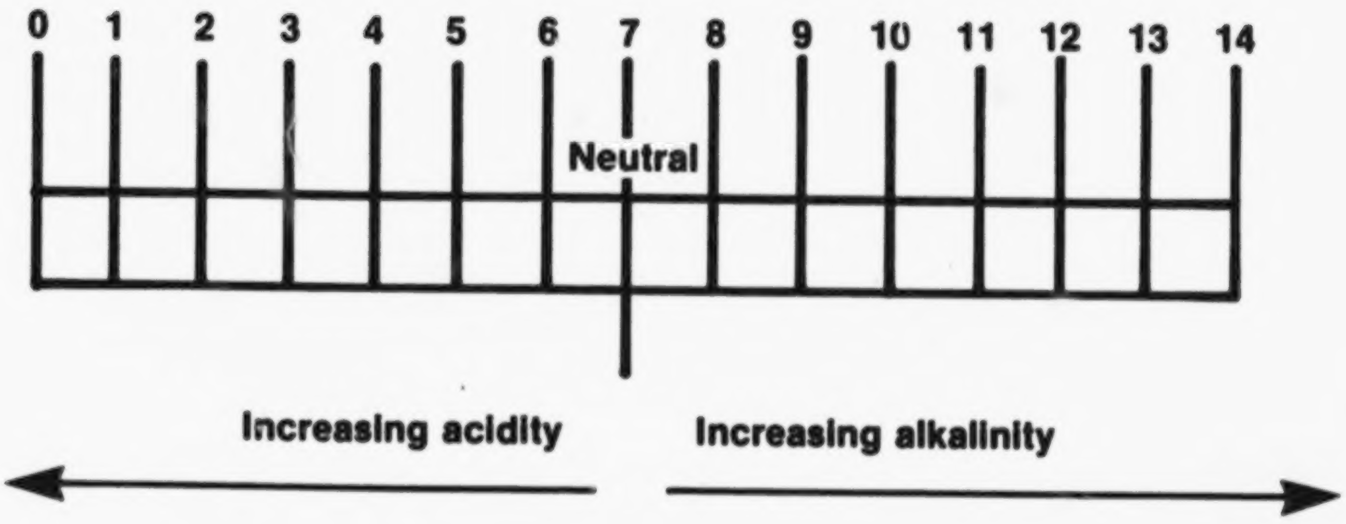
B Horizon

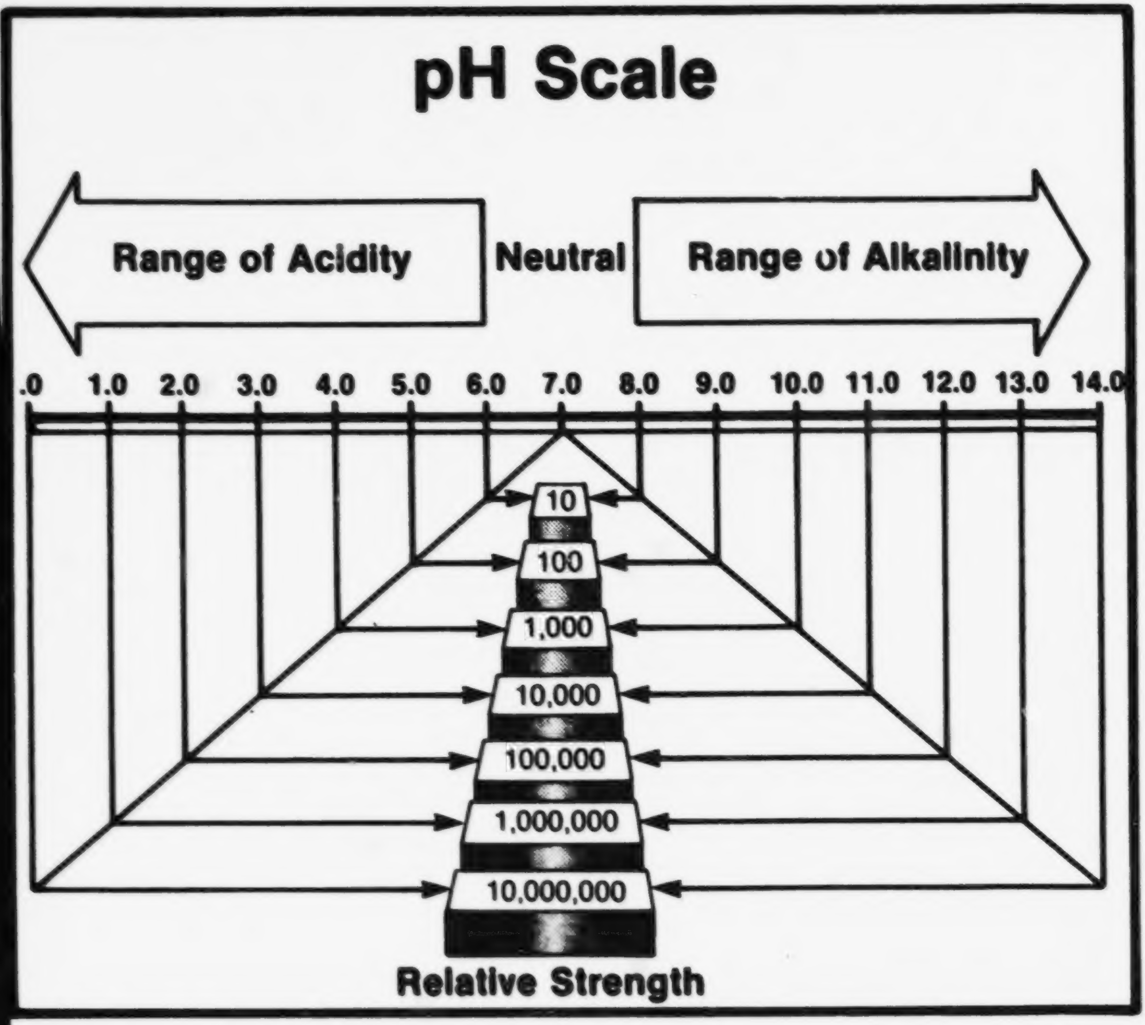
Mineral materials which accumulate organic matter, clay, iron, aluminum, etc. from layer above

C Horizon

Mineral material of weathered rock or other unconsolidated material

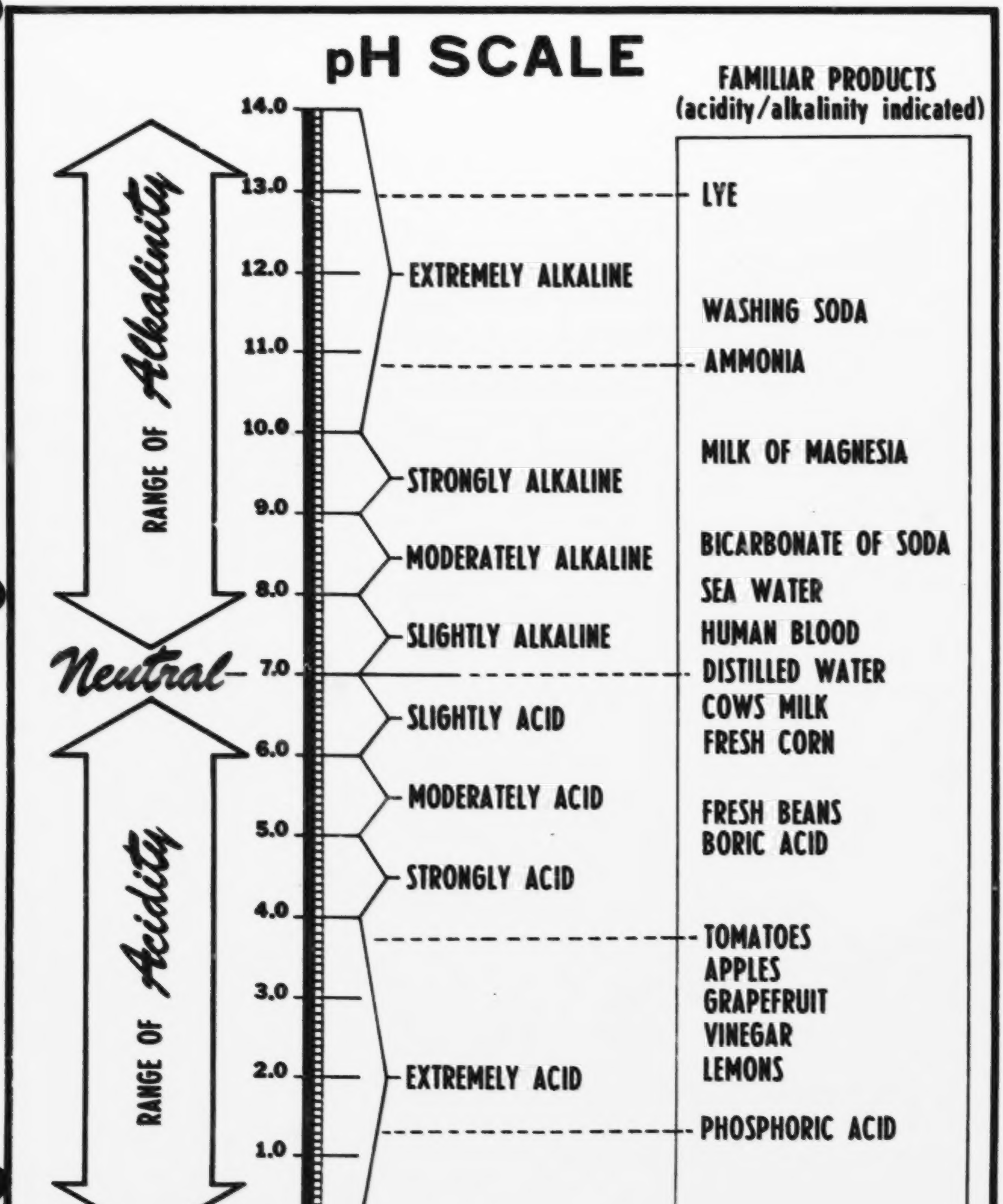
pH Scale


Neutral
Increasing acidity
Increasing alkalinity



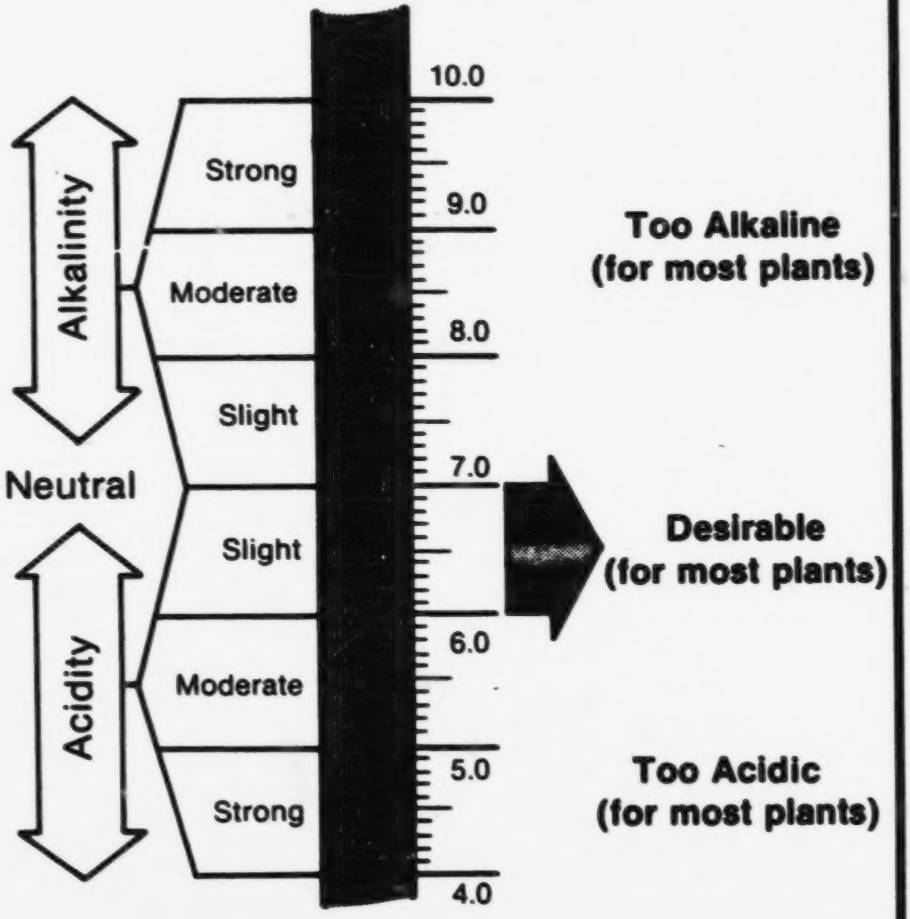
pH Scale

Range of Acidity
Neutral
Range of Alkalinity
.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
10
100
1,000
10,000
100,000
1,000,000
10,000,000
Relative Strength

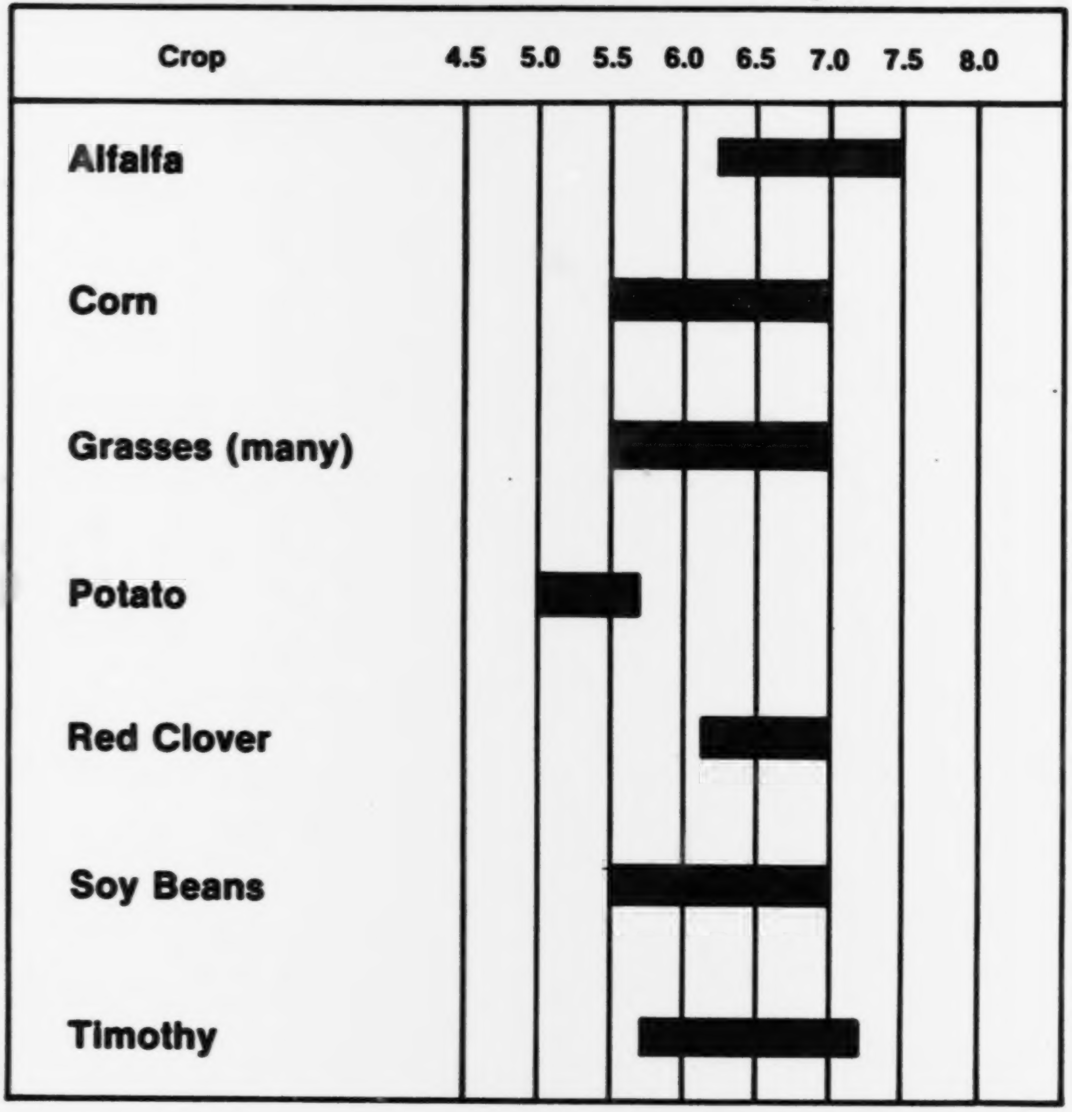

pH SCALE
FAMILIAR PRODUCTS
(acidity/alkalinity indicated)
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
.0
RANGE OF Alkalinity
Neutral
RANGE OF Acidity
EXTREMELY ALKALINE
STRONGLY ALKALINE
MODERATELY ALKALINE
SLIGHTLY ALKALINE
SLIGHTLY ACID
MODERATELY ACID
STRONGLY ACID
EXTREMELY ACID
LYE
WASHING SODA
AMMONIA
MILK OF MAGNESIA
BICARBONATE OF SODA
SEA WATER
HUMAN BLOOD
DISTILLED WATER
COWS MILK
FRESH CORN
FRESH BEANS
BORIC ACID
TOMATOES
APPLES
GRAPEFRUIT
VINEGAR
LEMONS
PHOSPHORIC ACID

pH Scale For Soil Reaction

(pH of 4 — 10)

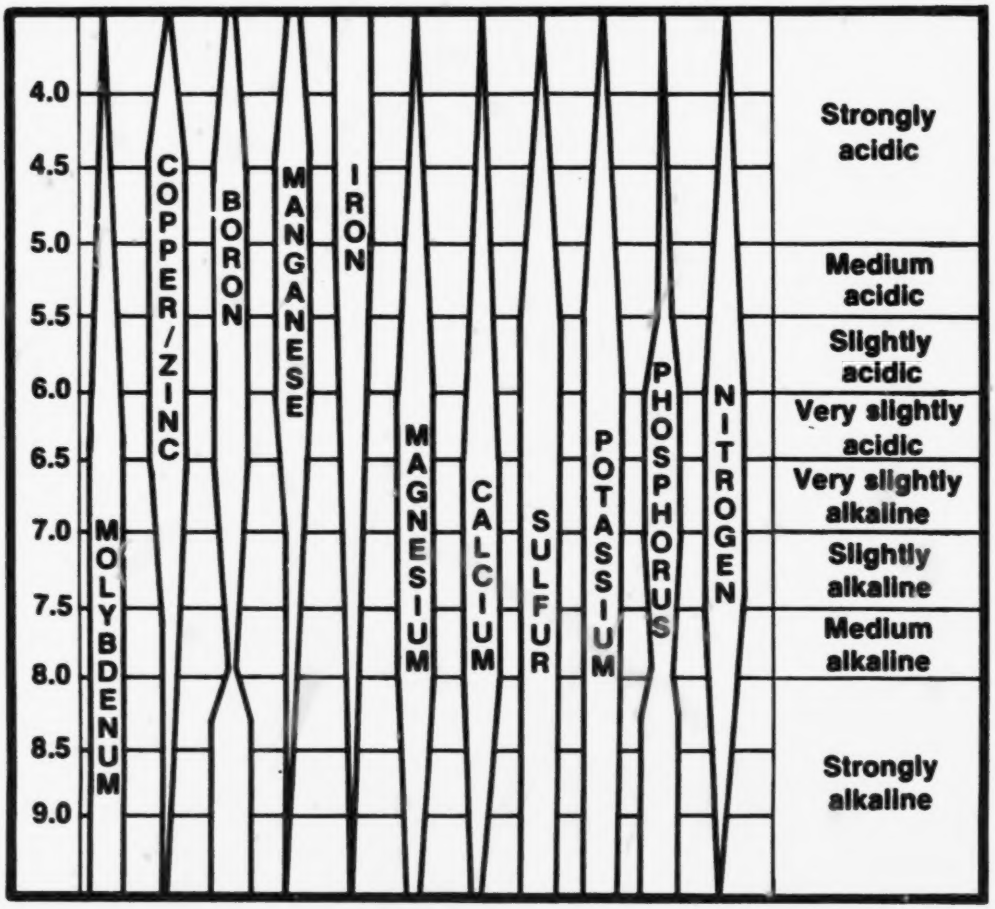

10.0
Strong
9.0
Alkalinity
Too Alkaline
(for most plants)
Moderate
8.0
Slight
7.0
Neutral
Slight
Desirable
(for most plants)
6.0
Acidity
Moderate
5.0
Too Acidic
(for most plants)
Strong
4.0

pH Requirements of Crops

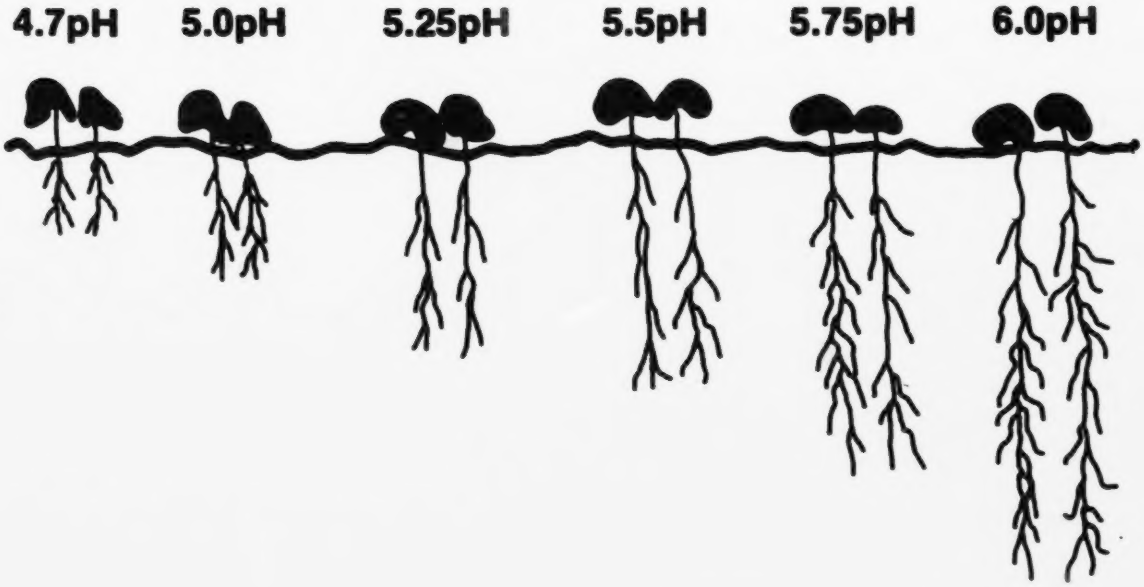


Soil pH Governs Nutrient Release

Acidity or alkalinity (pH) controls relative nutrient availability.



Low pH Limits Root Growth


4.7pH
5.0pH
5.25pH
5.5pH
5.75pH
6.0pH

Ion Exchange of Soil Particles

Figures 1:

Mineral nutrients held on the surface of a soil particle are absorbed

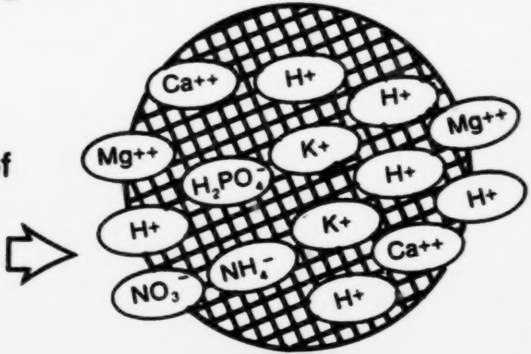

Ca++
H+
H+
Mg++
Mg++
K+
$H_2PO_4^-$
H+
H+
H+
K+
Ca++
NH_4^-
NO_3^-
H+

Figure 2:

A soil particle with mostly hydrogen ions tests ACID

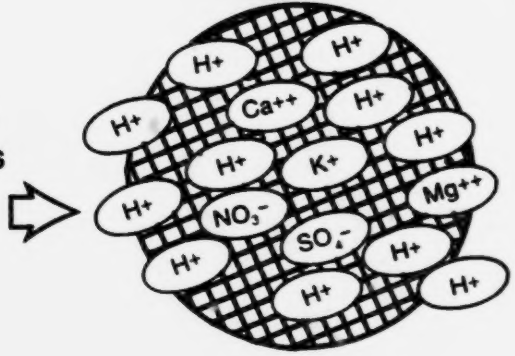
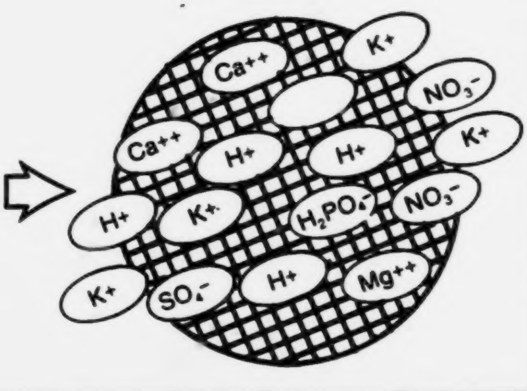

H+
H+
Ca++
H+
H+
H+
K+
H+
H+
Mg++
NO_3^-
SO_4^-
H+
H+
H+
H+

Figure 3:

A soil particle with mostly basic ions tests ALKALINE


Ca++
K+
NO_3^-
Ca++
H+
H+
K+
H+
K+
$H_2PO_4^-$
NO_3^-
K+
SO_4^-
H+
Mg++

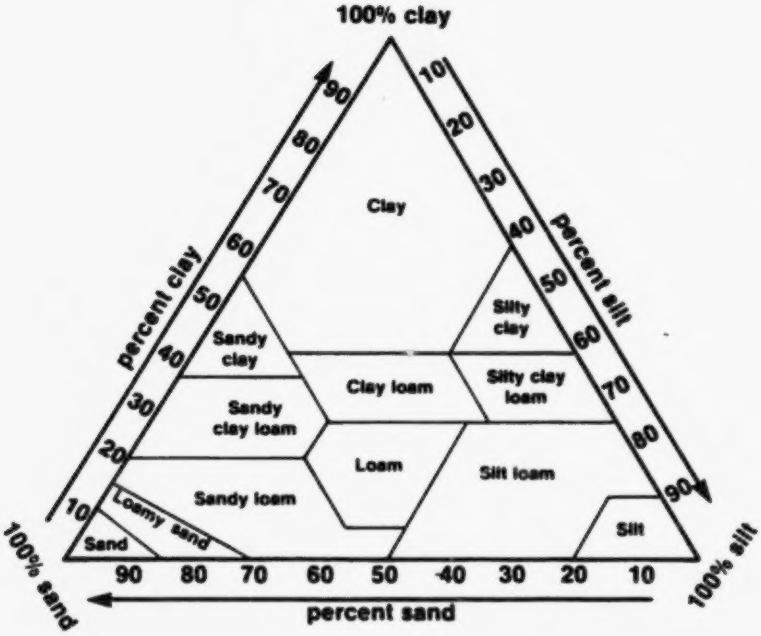
ELEMENTARY STUDY OF SOILS
UNIT 1

ASSIGNMENT SHEET #1: USING THE TEXTURAL TRIANGLE

Name____Score_______________

Part I

The textural triangle (Figure 1) can be used to determine the textural class of a soil sample. The percentage of sand, silt, and clay can be calculated by mechanical analysis.


100% clay
percent clay
90
80
70
60
50
40
30
20
10
percent silt
10
20
30
40
50
60
70
80
90
Clay
Sandy clay
Silty clay
Clay loam
Silty clay loam
Sandy clay loam
Loam
Silt loam
Sandy loam
Loamy sand
Sand
Silt
90
80
70
60
50
40
30
20
10
100% sand
percent sand
100% silt

To use the triangle, locate the percent sand along the bottom of the triangle. From this point move upward and to the left. The percent sand is the same along this line. Next locate the percent clay on the left side of the triangle and move horizontally to the right. The textural class is located where the clay and sand percents meet. This textural class can be checked by locating the silt percentage on the right side of the triangle and moving downward to the left. All points should intersect. If all lines intersect on a division line between classes, move towards the finer textured soil.

ASSIGNMENT SHEET #1

Part II

A. How much sand must a soil contain before it is called a:

1) Sandy clay loam_____ 3) Sand_____
2) Loamy sand_____ 4) Sandy clay_____

B. How much clay must a soil contain before it is called a:

1) Clay_____
2) Clay loam_____
3) Sandy clay loam_____
4) Sandy clay_____

C. Given the relative amounts of sand, clay, and silt, find the textural classes of the following:

1) 20% sand
20% clay _______________
60% silt

2) 55% sand
40% clay _______________
5% silt

3) 30% sand
40% clay _______________
30% silt

4) 20% sand
70% clay _______________
10% silt

5) 85% sand
10% clay _______________
5% silt

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ELEMENTARY STUDY OF SOILS
UNIT 1

ANSWERS TO ASSIGNMENT SHEETS

1. Part I--Evaluated to satisfaction of instructor

2. Part II

   A. 1) 45%, 2) 70%, 3) 85%, 4) 45%

   B. 1) 40%, 2) 27%, 3) 20%, 4) 35%

   C. 1) Silt loam, 2) Sandy clay, 3) Clay, 4) Clay,
   5) Loamy sand

ELEMENTARY STUDY OF SOILS
UNIT 1

JOB SHEET #1: DETERMINE SOIL TEXTURAL CLASS BY MECHANICAL ANALYSIS

I. Equipment Needed

  A. Quart fruit jars with lids

  B. 8% calgon solution

  C. Ruler, pencil, and paper

  D. Tablespoon

  E. A variety of soil samples

II. Procedure

  A. Fill the quart fruit jar 1/2 full of soil.

  B. Add 5-6 tablespoons of calgon solution and neatly fill the quart jar with water.

  C. Put the lid on the jar and shake for 5 minutes. Let the jar stand for 24 hours.

  D. Measure the depth of the settled soil at the end of 24 hours. This is the total depth.

  E. Thoroughly shake for 5 minutes. Let the jar set.

  F. Measure the depth of the settled soil at the end of 40 seconds. This is the sand layer.

  G. Measure the depth of the settled soil at the end of 30 minutes.

  H. Subtract the first depth (sand) from this new depth of soil. This is the depth of the silt layer.

  I. Subtract the depth of sand and silt from the original total depth to determine the amount of clay.

  J. Calculate the percentage of each soil separately by dividing the depth of each soil separately by the original total depth (Figure 1).

  K. Determine the soil textural classification by using the soil textural triangle (Figure 2).

Figure 1:

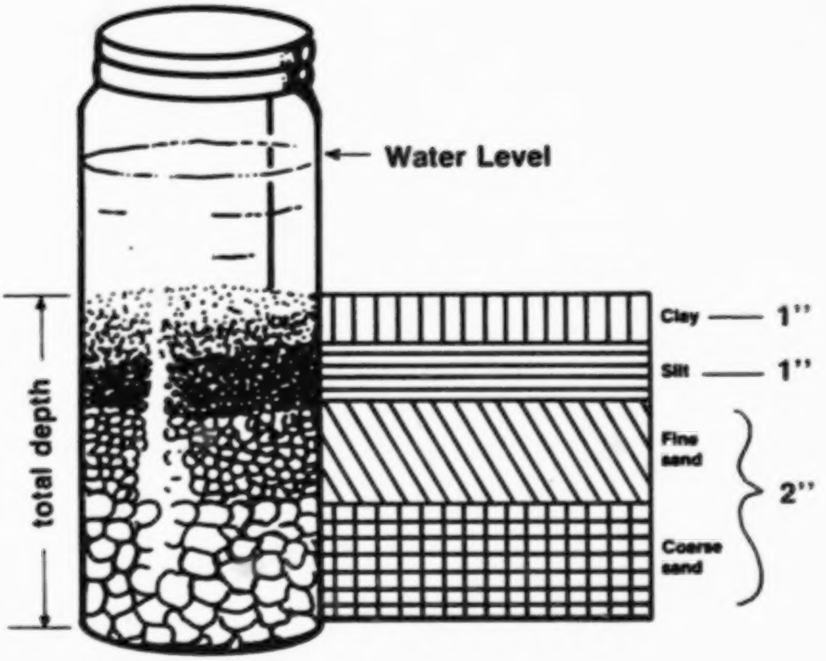
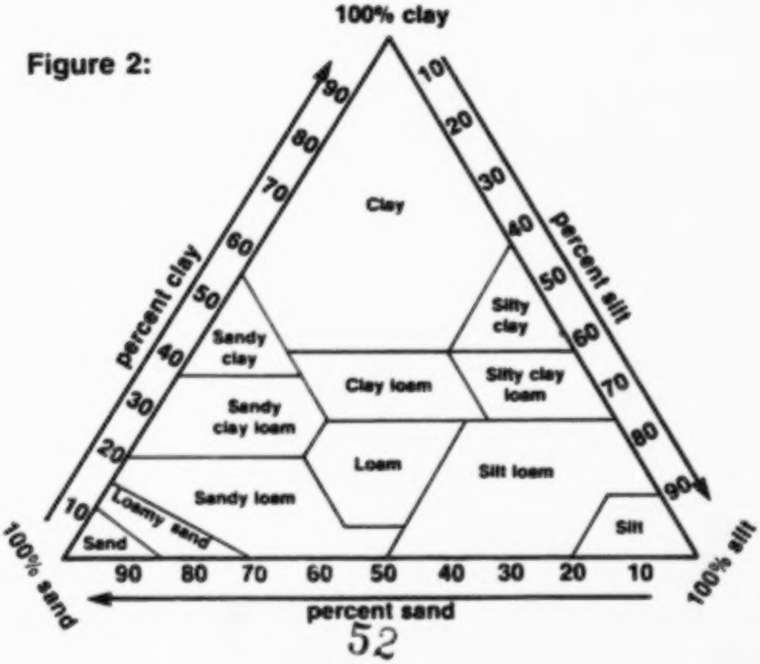

Water Level
total depth
Clay — 1''
Silt — 1''
Fine sand
Coarse sand
2''

Figure 2:


100% clay
percent clay
percent silt
percent sand
100% sand
100% silt
Clay
Sandy clay
Silty clay
Clay loam
Silty clay loam
Sandy clay loam
Loam
Silt loam
Sandy loam
Loamy sand
Sand
Silt
10
20
30
40
50
60
70
80
90

ELEMENTARY STUDY OF SOILS
UNIT 1

JOB SHEET #2: DETERMINE SOIL TEXTURAL CLASS BY FEEL

Name____Score________________

I. Equipment Needed

A. Spray bottle filled with water

B. Sink (to wash hands)

C. Paper towels

D. A variety of soil samples

II. Procedure

A. Review soil textural class characteristics

1. Sand or loamy sand--Dry-loose, single grained; gritty; no or very weak clods. Moist-gritty; forms easily crumbled ball; does not ribbon. Wet-lacks stickiness, but may show faint clay stainings (loamy sand especially). Individual grains can be both seen and felt under all moisture conditions.

2. Sandy loam--Dry-clods break easily. Moist-moderately gritty to gritty; forms balls that stands careful handling; ribbons very poorly. Wet-definitely stains fingers; may have faint smoothness or stickiness, but grittiness dominates. Individual grains can be seen and felt under nearly all conditions.

3. Loam--This is the most difficult texture to place since characteristics of sand, silt, and clay are all present but none predominates. Suggests other textures. Dry-clods slightly difficult to break; somewhat gritty. Moist-forms firm ball; ribbons poorly; may show poor fingerprint. Wet-gritty, smooth, and sticky all at same time. Stains fingers.

4. Silt or silt loam--dry-clods moderately difficult to break and rupture suddenly to a floury powder that clings to fingers; shows fingerprint. Moist-has smooth, slick, velvety, or buttery feel; forms firm ball; may ribbon slightly before breaking; shows good fingerprint. Wet-smooth with some stickiness from clay; stains fingers. Grittiness of sand is well masked by other separates. (Texture most like silt loam; there are few silt soils).

5. Sandy clay loam--Dry-clods break with some difficulty. Moist-forms firm ball that dries moderately hard; forms 1/2" ribbons that hardly sustain own weight; may show poor to good fingerprint. Wet-grittiness of sand and stickiness of clay about equal, masking smoothness of silt; stains fingers.

6. Clay loam--Dry-clods break with difficulty. Moist-forms firm ball that dries moderately hard; ribbons fairly well, but ribbons barely support own weight; shows fair to good fingerprint. Wet-moderately sticky with stickiness dominating over grittiness and smoothness; stains fingers.

7. Silty clay loam--Resembles silt loam but with more stickiness of clay. Dry-clods break with difficulty. Moist-shows a good fingerprint; forms a firm ball drying moderately hard; ribbons 1/2" that can be fairly thin. Wet-stains fingers; has stick-smooth feel with little grittiness of sand.

8. Sandy clay--Dry-often cloddy, clods broken only with extreme pressure. Moist-forms very firm ball, drying quite hard; shows fingerprint; squeezes to thin, long, somewhat gritty ribbon. Wet-stains fingers; clouds water; usually quite sticky and plastic, but has some grittiness present.

9. Silty clay--Dry-see sandy clay. Moist-forms very firm ball becoming quite hard on drying; shows fingerprint; squeezes out to a think, long, smooth ribbon. Wet-stains fingers; clouds water; stickiness dominates over smoothness, grittiness is virtually absent.

10. Clay--Dry-cloddy, clods often cannot be broken even with extreme pressure. Moist-forms firm, easily molded ball drying very hard; squeezes out to a very thin ribbon 2 to 3 inches long. Wet-stains fingers, clouds water; usually very sticky with stickiness masking both smoothness and grittiness; wets slowly.

B. Examine the dry soil sample

(Note: Look for clods and ease of crumbling them between your fingers. Remember soils high in sand are seldom cloddy. Soils high in silt may be cloddy but usually break easily. Clay soils are usually cloddy and are often hard to break.)

C. Take a quantity of soil about the size of a golf ball. Moisten it with water from the spray bottle to the consistency of putty.

JOB SHEET #2

D. Try to form a ball with the moistened soil sample; then try to form a "ribbon" by working the soil between the thumb and forefinger.

(Note: Soils high in sand feel gritty and ribbon poorly unless also high in clay. Soils high in silt feel smooth or floury. They may also form a short ribbon in verying length depending on the clay content. Soils high in clay can be rolled out into very thin ribbons.)

E. Saturate the soil sample and note staining on the fingers.

(Note: Clay or loam soil is indicated if the moist soil ball stains your fingers.)

F. Compare several soil samples of different textures.

(Note: Compare the amount of grittiness of sand to the smoothness of silt and the stickiness of clay. Sand gives a grinding sound when held close to the ear. Grittiness indicates a sandy soil. Silt is smooth and velvety. Clay is sticky.)

ELEMENTARY STUDY OF SOILS
UNIT 1

TEST

NAME______________________________ SCORE__________

1. Match terms associated with elementary study of soils to the correct definition. Write the correct numbers in the blanks.

    1. Soil
    2. Mineral matter
    3. Organic matter
    4. Parent material
    5. Soil texture
    6. Soil structure
    7. Aggregate
    8. Soil depth
    9. Soil color
    10. Soil profile
    11. Soil horizon
    12. Topsoil
    13. Subsoil
    14. Acid soil
    15. Alkaline soil
    16. Leaching
    17. Reclamation
    18. Cation
    19. Anion
    20. Exchange capacity

____a. A mixture of particles of rock, organic materials, living organisms, air and water

____b. Removal of water soluble soil components from the downward action of water

____c. Total thickness of a soil from the topsoil to the parent material

____d. Dark colored upper layer of soil that may vary from several inches to 2 or more feet thick

____e. A vertical cross-section of the soil from the surface through all its horizons

____f. Mass or cluster of soil particles such as a clod, crumb or granule

____g. Soil having a pH value greater than 7.0

____h. General term for inorganic elements in the soil, i.e. nitrogen, phosphorus, potassium

____i. A name given a textural group based on the relative proportions of the various soil separates

____j. A layer of soil approximately parallel to the land surface, differing from other layers in color, structure, texture, pH, etc.

____k. The layer of soil directly beneath the topsoil

____l. General term for plant and animal material in or on the soil in all stages of decomposition

TEST

____m. Indication of the amount of organic matter and moisture of the soil

____n. Soil with a pH of less than 7.0

____o. An ion that has lost as electron and has a positive (+) charge, e.g. potassium, calcium and magnesium

____p. The ability of a soil to absorb ions to the surface of the soil particle

____q. Restoration to a better or useful state, as of wasteland, desert, alkali, etc.

____r. The combination or arrangement of soil particles into aggregates

____s. The rock or other unconsolidated materials from which the soil has developed

2. Select from the following list reasons that soils are important. Write an "X" in the blank before each correct answer.

   ____a. Holds the earth together

   ____b. Provides food

   ____c. Population is increasing

   ____d. Productive soil is limited

   ____e. Provides insulation

   ____f. Provides a base on which to build houses

3. Discuss the function of soil as related to plant growth, development and maintenance.

____

____

____

____

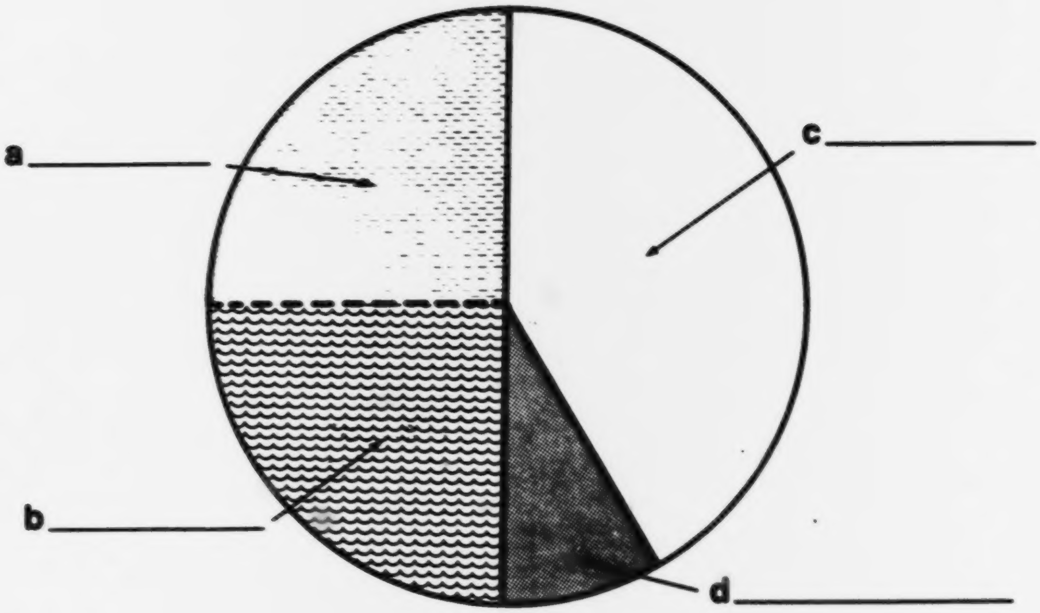
____

____

____

TEST

4. Label the drawing below showing the composition of an average soil. Write the correct names in the blanks.



5. Select from the following list factors that are important in soil formation. Write an "X" in the blank before each correct answer.

____a. Freezing and thawing of parent material

____b. The amount of rainfall

____c. The type of soil structure

____d. The steepness or flatness of the landscape

____e. The presence of clay in the "B" horizon

____f. The amount of vegetation present

6. Name the four physical properties of soils

a. ________________________________

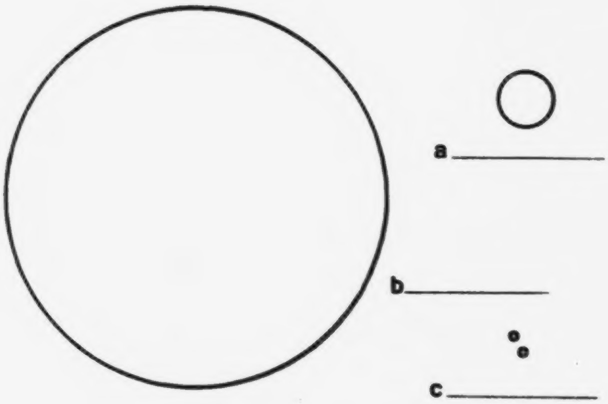
b. ________________________________

c. ________________________________

d. ________________________________

TEST

7. Identify the soil particles according to size.



8. Discuss two methods used to determine soil texture.

a.

b.

9. Identify the five kinds of soil structure in the illustrations below.

TEST

10. Match terms indicating soil depth to their correct description. Write the correct numbers in the blanks.

____a. More than 36 inches deep 1. Deep

____b. 20 to 36 inches deep 2. Moderately deep

____c. 10 to 20 inches deep 3. Shallow

____d. Less than 10 inches deep 4. Very shallow

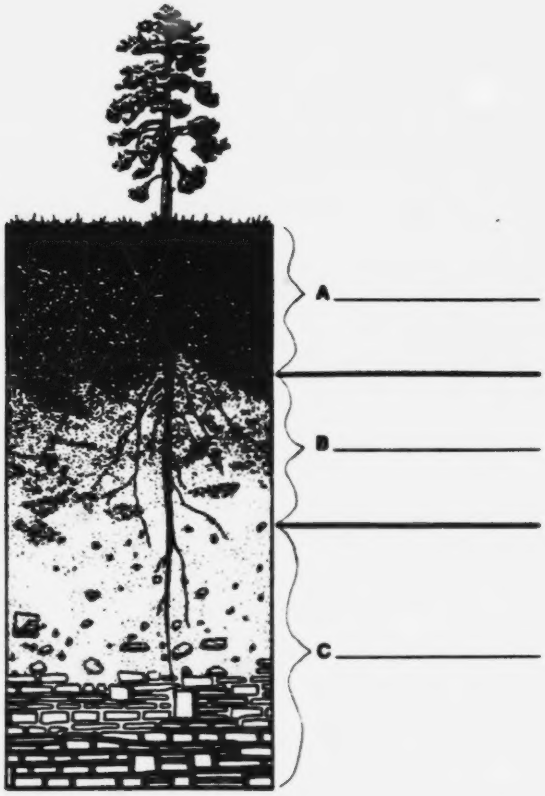
11. Match the colors of the soil to their correct description. Write the correct numbers in the blanks.

____a. High iron content 1. Dark brown to black

____b. Caused by imperfect drainage 2. Red or reddish-brown

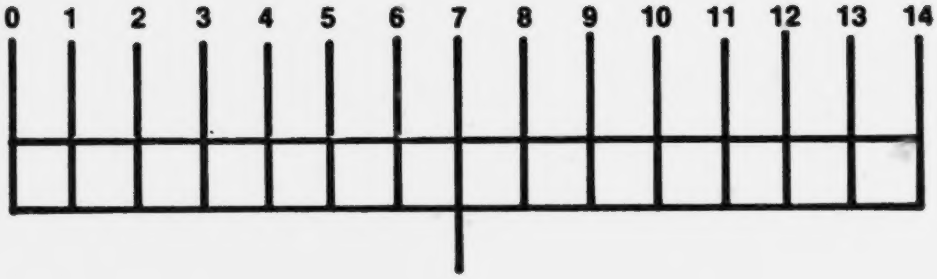
____c. High organic matter content 3. Yellow or gray

12. Label the illustration showing the layers of a soil profile. Write the correct names in the blanks.



TEST

13. Identify on the pH scale the area of acidity and the area of alkalinity.



14. Discuss the liming of soils to correct soil acidity.

15. Name three types of alkali soils.

a. ____________________

b. ____________________

c. ____________________

16. Discuss reclamation of alkali soils.

ANSWERS TO UNIT TEST

14. Discussion should include: the function of lime is to neutralize hydrogen (H+) ions that cause soil acidity.

15. a. Saline, b. Sodic, c. Saline-sodic

16. Discussion should include management practices involved in the reclamation of alkali soils.

ELEMENTARY STUDY OF SOILS
UNIT 1

ANSWERS TO UNIT TEST

1. a. 1
    b. 16
    c. 8
    d. 12
    e. 10
    f. 7
    g. 15
    h. 2
    i. 5
    j. 11
    k. 13
    l. 3
    m. 9
    n. 14
    o. 18
    p. 20
    q. 17
    r. 6
    s. 4

2. b, c, d

3. Discussion may include: (a) media for seed germination, (b) media for support of plants, (c) storehouse of plant nutrients, and (d) storehouse of water for the plant.

4. a. Air
    b. Water
    c. Mineral matter
    d. Organic matter and living organisms

5. a, b, d, f

6. a. Soil structure
    b. Soil texture
    c. Soil depth
    d. Soil color

7. a. Silt, b. Sand, c. Clay

8. a. Mechanical analysis, b. Feel method

9. a. Single grain
    b. Blocky
    c. Platy
    d. Massive
    e. Granular
    f. Prismatic

10. a. 1, b. 2, c. 3, d. 4

11. a. 2, b. 3, c. 1

12. a. A horizon, b. B horizon, c. C horizon

13. Acid--pH values less than 7.0
    Alkaline--pH values greater than 7.0

SOIL FERTILITY
UNIT 2

UNIT OBJECTIVE

After completing this unit, the student should be able to classify essential nutrients as primary, secondary or micronutrient, and match function and deficiency symptoms to the correct nutrient. The student should be able to interpret soil test information, determine the amount of fertilizer to apply, and calculate nutrient cost. This knowledge will be shown by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with soil fertility to the correct definitions.
2. Classify the essential nutrients for plant growth as being primary, secondary, or micronutrient.
3. Match the functions of nutrients for crop growth to the correct nutrient.
4. Match nutrients to their correct deficiency symptoms.
5. Select from a list factors that influence the use of fertilizers.
6. Discuss major points in collecting and handling a representative soil sample.
7. Calculate amounts of fertilizer required per acre using soil test and fertilizer guide information.
8. Discuss major points in collecting and handling a representative plant tissue sample.
9. List four sources of nutrients.
10. Select from a list the information that must be stamped on fertilizer bags according to state law.
11. Match types of fertilizer analyses to their correct description.
12. Match types of fertilizers to their correct description.
13. Calculate problems comparing cost per pound of nutrient.
14. Formulate a fertilizer blend.
15. List three methods of fertilizer application.

SOIL FERTILITY
UNIT 2

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit

      1. Literature

         a. Soils Handbook - A 3-ring indexed notebook on soils emphasizing soil fertility; available from Department of Agricultural Information, College of Agriculture, University of Idaho, Moscow, ID 83843; approximate cost $15.00.

         b. Pamphlets on fertilizer use; available from Potash and Phosphate Institute, 2801 Buford Hwy., N.E., Suite 401, Atlanta, GA 30329; approximate cost 25¢ each.

         c. Taking Soil Samples, 25-page instructional manual, available from: IAVIM Center, ATTN: Thomas A. Hoerner, 208 Davidson Hall, Iowa State University, Ames, Iowa, 50011; approximate cost $2.50, order no. 212.

         d. Making Soil Fertility Decisions, 120-page instructional unit, available from: IAVIM Center; approximate cost $7.50, order no. 226.

      2. Filmstrips, slideshows, etc.

         a. Soil pH and Limestone, 7 slides, cassette and 1 film loop, 24 minutes, available from: Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $31.20, order no. D21.

         b. Soil Sampling and Soil Testing, 63-frame filmstrip and script, available from: IAVIM Center; approximate cost $8.75, order no. 314.

         c. Fertilizers and Soil Fertility, 3 cassettes, 3 filmstrips, program guide and reproducible masters, available from: Teaching Aids, Inc., P. O. Box 1789, Costa Mesa, CA, 92626; approximate cost $105.00, order no. P1321.

         d. Fertilizer Purchase, 1 disk and worksheet, available from: Teaching Aids, Inc., P. O. Box 1789, Costa Mesa, CA, 92626; approximate cost $22.00, order no. ACS-9.

SUGGESTED ACTIVITIES

e. Fertilizer Quarterly, 1 disk and worksheet, available from: Teaching Aids, Inc., P. O. Box 1789, Costa Mesa, CA, 92626; approximate cost $22.00, order no. ACS-10.

3. Films

B. Make transparencies

C. Provide students with objective sheet

D. Provide students with information and assignment sheets

E. Discuss unit and specific objectives

F. Discuss information and assignment sheets

G. Take soil sample from school yard or school farm for analysis

H. Have students bring a soil sample from home farm for analysis

I. Develop a fertilizer test plot for students to observe different fertilizing methods, rates, and results

J. Contact local fertilizer dealer for samples of different fertilizers

K. Give test

L. Reteach if necessary

M. Retest

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

SUGGESTED ACTIVITIES

D. Transparency masters

1. TM 1--Chemical elements essential to plant growth
2. TM 2--Ten essential elements
3. TM 3--Profits can fall if any nutrient is short
4. TM 4--Nitrogen deficiency in corn
5. TM 5--Phosphate deficiency in corn
6. TM 6--Potash deficiency in corn
7. TM 7--Factors that influence fertilizer use
8. TM 8--Soil sampling (A-B)
9. TM 9--Soil sampling (C-D)
10. TM 10--Soil sampling (E-F)
11. TM 11--Soil sampling (G-H)
12. TM 12--Soil sampling
13. TM 13--Soil sample bag
14. TM 14--Soil test report
15. TM 15--Nutrient Sources
16. TM 16--Information commonly found on a fertilizer bag
17. TM 17--Fertilizer analysis
18. TM 18--Plant nutrient blends
19. TM 19--Compare cost per pound of nutrient, NOT cost per pound of fertilizer
20. TM 20--Calculate amount of fertilizer to apply

E. Assignment sheets

1. AS 1--Calculate number of pounds of actual nitrogen, phosphorus, and potassium available from different fertilizer analyses
2. AS 2--Calculate cost per pound of nitrogen for different fertilizer analyses

SUGGESTED ACTIVITIES

3. AS 3--Calculate application rates of fertilizers

4. AS 4--Formulate a fertilizer blend

5. AS 5--Complete a soil test report form

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Agronomy Curriculum Workshop, Ames Iowa, Iowa State University, Dept. of Agricultural Education, 1980.

B. Crops, Soils, and Fertilizer Resource Manual, Vo Ed No. 73, Moscow, ID, University of Idaho, Department of Agricultural Education, 1978.

C. Oklahoma Curriculum Guide, Stillwater, OK, Oklahoma State University and the Oklahoma State Board for Vocational -Technical Education.

D. Texas Curriculum Guide, Vocational Instruction Services, Texas State Board for Vocational Education.

E. Kauti, Williams, and Hide, Profitable Soil Management, Englewood Cliffs, NJ, Prentice-Hall Inc., 3rd Edition, 1979.

F. Tisdale and Nelson, Soil Fertility and Fertilizers, Toronto, Canada. Tha Macmillan Co., 2nd Edition, 1969.

G. Soil Improvement Committee, California Fertilizer Association, Western Fertilizer Handbook. Danville, Illinois, The Interstate Printers and Publishers, 1980.

H. Cooperative Extension Service, Soils Handbook, Moscow, Id, College of Agriculture, University of Idaho.

I. Clarence R. Fridline, Field Crop Nutrition, Columbus, OH, Ohio Agricultural Curriculum Materials Service, Ohio State University.

SOIL FERTILITY
UNIT 2

INFORMATION SHEET

I. Terms and definitions

   A. Essential nutrient--Element necessary for plant growth and reproduction, e.g. nitrogen, phosphorus, and potassium

   B. Deficiency--Plant condition where an essential nutrient is not sufficiently available

   C. Symptom--A visual sign or condition that results from a deficiency; symptoms aid in diagnosing a deficiency

   D. Fertilizer--Natural, manufactured or processed material or mixture of materials that contains one or more of the essential nutrients; available in dry, liquid or gaseous form

   E. Analysis--Percentage water soluble content of nitrogen (N), phosphorus (P) expressed as P_2O_5, and potassium (K) expressed as K_2O in the fertilizer

   F. Brand--Trademark of the company which produced the fertilizer

   G. Complete fertilizer--Fertilizer which supplies all three of the primary nutrients (N, P, K)

II. Essential nutrients for plant growth (Transparencies #1, 2 and 3)

(Note: Plants require 16 nutrients for healthy growth. These nutrients are obtained from either air, water or soil. From these basic nutrients, plants can put together all of the necessary substances needed for growth and storage of food.)

   A. Non-mineral--from air and water

      1. Hydrogen (H) - from water

      2. Oxygen (O) - from water and air

      3. Carbon (C) - from air

   B. Mineral--from the soil

      1. Primary nutrients--needed in large amounts

         a. Nitrogen (N)

         b. Phosphorus (P)

         c. Potassium (K)

INFORMATION SHEET

2. Secondary nutrients--needed in intermediate amounts
    a. Sulphur (S)
    b. Calcium (Ca)
    c. Magnesium (Mg)
3. Micronutrients--needed in small amounts
    a. Boron (B)
    b. Manganese (Mn)
    c. Zinc (Zn)
    d. Copper (Cu)
    e. Iron (Fe)
    f. Chlorine (Cl)
    g. Molybdenum (Mo)

III. Functions of nutrients for crop growth

A. Carbon, hydrogen, and oxygen are needed in the plant processes of photosynthesis and respiration

(Note: Importance of photosynthesis to net gain in weight should be emphasized. Approximately 95% of weight of crop plants comes from products of photosynthesis.)

B. Primary nutrient functions

1. Nitrogen (N)
    a. Gives green color to plant
    b. Induces vigorous, rapid growth in plants
    c. Increases protein and yield
    d. Aids and promotes seed and fruit development

(Note: Excess nitrogen causes vegetative growth and poor seed and fruit production. Nitrogen constitutes 80% of the atmosphere, yet it is one of the most critical elements for plant growth. The reason is that plants cannot utilize nitrogen as a gas; it must be combined with other elements into a plant available form.)

INFORMATION SHEET

2. Phosphorus (P)
    a. Important to germinating seedlings
    b. Contributes to early maturing crops
    c. Is necessary for seed and fruit formation
    d. Stimulates root growth
3. Potassium (K)
    a. Is necessary for production and translocation of carbohydrates
    b. Produces plumper seeds
    c. Controls water intake and respiration
    d. Stiffens straw and stalks

C. Secondary nutrient functions

1. Sulphur (S)
    a. Is necessary for nodule formation on legumes
    b. Is associated with plant enzyme systems
    c. Stimulates seed production
    d. Affects protein and crop quality
2. Calcium (Ca)
    a. Speeds decay of organic matter
    b. Stimulates formation of nitrates
    c. Promotes root and leaf growth
    d. Is necessary for nodulation of legumes
3. Magnesium (Mg)
    a. Is necessary for chlorophyll or green plant color
    b. Increases absorption of phosphorus
    c. Aids in formation of fats and oils
    d. Is important in plant enzyme system

INFORMATION SHEET

IV. Symptoms of nutrient deficiencies

A. Primary nutrient deficiency symptoms

1. Nitrogen (N) (Transparency #4)

a. Stunted and spindly

b. Yellow, yellowish-green, or light green color in foliage (chlorosis)

c. Older leaves affected first

(Note: Yellowing or browning starts at the tip and moves along the middle of the leaf. This occurs first on the lower most leaves of the plant.)

2. Phosphorus (P) (Transparency #5)

a. Stunted growth

b. Very dark green color

c. Purple leaves or portions of leaves in advanced stages

d. Older leaves affected first

3. Potassium (K) (Transparency #6)

a. Shorter plants

b. Bronzing or browning of leaf color

c. Lodging (bending of the stem) occurs

(Note: Leaves show yellow to brown coloring along leaf margins followed by complete browning.)

B. Secondary nutrient deficiency symptoms

1. Sulphur (S)

a. Young plants have stunted appearance

b. Leaves have a light-green to yellow coloring

c. Stems are thin and spindly

(Note: Sulphur deficiency symptoms are similar in appearance to nitrogen deficiency symptoms.)

INFORMATION SHEET

2. Magnesium (Mg)

   a. Leaf parts between veins show a whitish color

   b. Leaf tissue becomes yellow, veins remain green (interveinal chlorosis)

   c. Leaves curl upward along the margins

   (Note: It is important to note that other conditions besides nutrient shortages may cause abnormal plant growth. Cold, wet weather, lack of sunlight, disease, insect damage, and improperly applied chemicals are examples.)

V. Factors that influence fertilizer use (Transparency #7)

   A. Fertility of the soil

   (Note: The fertility of the soil is dependent on the availability of total nutrients in the soil, soil organic matter and can be determined by soil test.)

   B. Physical condition of the soil

   (Note: Moisture content, soil texture, soil structure, the ability to prevent leaching are important physical conditions to consider in fertilizer use.)

   C. Crop to be grown

   (Note: Nutrient needs vary between crop plants . The cost of the type of fertilizer compared to the value of the crop is an important consideration.)

   D. Climatic conditions, i.e. temperature and moisture

   E. Time of application, i.e. fall, spring, or during season

VI. Soil testing to determine nutrient needs (Transparencies #8, #9, #10, #11, #12, #13 and #14)

(Note: If you apply fertilizer that is not needed, you are wasting money. On the other hand, you will lower crop yields if you don't apply enough. Confusing? Sure. That's why soil testing is so highly recommended. A soil test is a guide to fertilizer needed for your farm. Consult your cooperative extension agent or refer to the "Soils Handbook" published by the College of Agriculture, University of Idaho, for more information on procedure and cost.)

INFORMATION SHEET

A. There are five main steps involved in taking a good soil sample. They are:

   1. To obtain needed materials for the sample

   2. To select a good time to take the sample

   3. To select good sampling areas

   4. To collect representative samples

   5. To send the sample to a soil testing laboratory

   (Note: Soil tests are only as good as sample taken.)

B. Materials needed for sampling

   1. Soil auger or shovel to take soil cores

   (Note: Always use clean tools so sample will not be contaminated.)

   2. Plastic pail for mixing core samples

   (Note: Mix sample well so sample will be representative of soil cores.)

   3. Soil sample bags and information sheet

   4. Map of your fields

C. When to take sample

   1. After harvest, before fall fertilization

   2. Spring, before spring fertilization

   (Note: Do not sample after a lime, fertilizer, or manure application or when soil is excessively wet. Sampling at other times such as in winter or in a growing crop can be satisfactory if you can divide the field into uniform sampling areas and take soil samples to the proper depth.)

D. What is a good sampling area

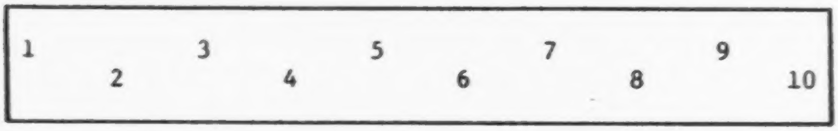
1. Sample areas depend on field size and soil types in field

2. Sample area should represent an area with similar past management and soil types

   (Note: Soil survey maps from local SCS may be helpful in determining areas with common soil type, slope and erosion. If a recent soil survey map is not available, sampling areas should be separated on the basis of visual differences, such as texture, color and slope. Avoid areas not representative of the uniform field area, such as old fence lines, eroded areas, etc.)

E. Collecting representative samples

1. Take 8 to 12 separate cores in a zig-zag pattern from a ten-acre sampling area



2. Take 10 to 15 cores if the area is variable

3. Take core samples by 12 inch increments

   (Note: For nitrogen, sulphur and other mobile nutrients, sample to rooting depth. For phosphorus, potassium and the micronutrients, sample to 12".)

4. Place cores in a clean, plastic pail and mix cores thoroughly

   (Note: Be sure to clear away any plant material or surface trash where core is to be taken. Plastic pail is recommended because the sample can absorb nutrients (esp. zinc) from the metal coating on the bucket and give your erroneous results on the soil test.)

F. Sending sample to be tested

1. Each soil sample bag should be identified and numbered before filling

   (Note: Label all samples correctly and identify area on farm map where sample was taken.)

2. Fill soil sample bag one-half to two-thirds full with thoroughly mixed soil from pail

3. Securely close the bag

4. Complete the soil test report

   (Note: Information on cropping history and the crop to be grown is useful and usually required on information sheet if accurate fertilizer recommendations are wanted.)

5. Send samples and the completed soil test report to the desired soil testing laboratory

   (Note: Be sure to indicate type of soil test desired. Some of the more common tests are the following: phosphorus, potassium, nitrogen, organic matter, zinc, sulphur, and soil pH. Consult county agent or soil specialist in your area for the soil tests you need.)

   (Note: In Idaho, take samples to local county agent, or mail to:

   Soil Testing Laboratory
   Ag Science Building
   University of Idaho
   Moscow, ID 83843

G. How often to test soil

1. Each field should be sampled every 3 to 5 years or once in a crop rotation; nitrogen should be run each year.

   (Note: If fertilizer applications do not appear to be beneficial, resampling should be done.)

VII. Completing a soil test report form

A. Interpreting soil test results

(Note: Numbers are meaningless without interpretation. Interpretations are based on research on response of the crop at various soil test levels. Fertilizer guides are available for most agronomic crops raised in Idaho. These guides are used in conjunction with the University of Idaho soil test results, but may also be used with soil test results from private laboratories. Each of the guides is specific to a crop and an area of the state. The fertilizer guides are accurate if: (1) the soil sample submitted was properly taken and represents the area to be fertilized, (2) the crop to be grown and previous history are known, and (3) reasonable management occurs.)

INFORMATION SHEET

VIII. Plant tissue analysis to determine nutrient needs

(Note: Plant tissue analysis is an excellent tool for diagnosing nutrient status and needs for plants. It generally involves collecting a certain portion of the plant, e.g. petiole, root, stem, or leaf to be analyzed. Nutrient levels vary from one part of the plant to another and change with age or maturity. Consequently, the part of the plant taken and time of sampling will depend on research that has been done on that specific crop.)

A. Collecting plant tissue sample

1. Determine part of plant to sample

   (Note: Petioles are collected for tissue sampling of potatoes and sugarbeets.)

2. Collect enough samples to be representative of a field

   (Note: 40 petioles per 160-acre field is recommended for potatoes and sugarbeets.)

3. Do not collect samples from areas that are obviously different from the rest of the field

   (Note: Do not sample edges of field or near tire tracks on center pivot irrigation systems.)

4. Follow sampling pattern

   (Note: Sampling pattern will be determined by the shape and uniformity of the field; Following a pattern will help ensure the sample is representative of the field.)

5. For crops sampled periodically during the season, they should be sampled at the same time of day

   (Note: This is especially important when monitoring nitrate levels in the samples. Nitrates accumulate in plant tissue at night and are utilized by plants during the day. Nitrate levels may vary 10%-15%.)

B. Handling plant tissue sample

1. Obtain representative sample from the field

2. Partially air dry sample

INFORMATION SHEET

3. Fill in required information on sample form

   (Note: Consult your cooperative extension agent or refer to the "Soils Handbook" published by the University of Idaho, College of Agriculture, for more information on procedure, forms, and cost.)

4. Mail to testing lab in white paper bag

   (Note: Brown bags have contamination in the glue. Either white or brown bag may be used if testing only for nitrate-nitrogen (N-NO_3). Do not use plastic bag as samples will mold.)

C. Interpretation of results

1. Crop logging--Crop is sampled periodically throughout the growing season; the data is plotted on a graph and trends are considered deciding whether additional fertilizer is required

   (Note: Consult your extension crop specialist or management consultant for interpretation of data you have logged on your field.)

IX. Nutrient Sources (Transparency #15)

A. Animal manure--The liquid and solid excrement of animals mixed with bedding material; is used to supply nutrients for plant growth; helps add organic matter to the soil

   (Note: Organic matter is the soil's storehouse for nitrogen. Almost all of the N in the soil is part of the organic matter. When organic matter decomposes, N is released and changes to available forms for plant use. The nutrient content of animal manure may vary considerably under different livestock production systems, amount and type of bedding, and methods of handling the manure produced.)

B. Crop residues--Are leaves, stems, roots, and other parts of plants remaining in the field after harvest, e.g., wheat stubble, corn stover, potato vines, sugarbeet tops, etc.

C. Green manure crops--A crop grown to be plowed under in a green, succulent condition for soil improvement purposes; usually a legume crop which fixes atmospheric nitrogen

D. Commercial fertilizers--Commercially prepared plant nutrients; are applied to soils to increase their productivity by supplying additional essential nutrients

INFORMATION SHEET

X. Information on fertilizer (bulk or bags) (Transparency #16)

A. The net weight

B. Name and address of manufacturer or distributor

C. The guaranteed analysis of the material

D. Name, brand or trademark

(Note: Fertilizer materials are sold by the bag, gallon or tank truck, pressure tanks and dry bulk in trucks. It is important to remember that state laws require the seller of fertilizer to guarantee the nutrient content to the buyer. This information is listed on a tag or on the bag. Bulk fertilizer sales must have the same information on the invoice. If problems arise, contact the State Department of Agriculture, Boise, ID)

XI. Fertilizer analyses (Transparency #17)

(Note: A fertilizer analysis consists of three numbers. These three figures indicate the water soluble plant nutrient content of the material. The first figure represents the actual pounds of nitrogen in 100 pounds of fertilizer. The second figure represents the actual pounds of phosphorus expressed as P_2O_5. The third figure represents the actual pounds of water soluble potassium expressed as K_2O. The fourth number, if present, represents the actual pounds of sulfur.)

A. Ordinary analysis—less than 20% plant nutrients

EXAMPLE: 5-5-5

B. High analysis--20% to 30% plant nutrients

EXAMPLE: 5-10-5

C. Concentrated analysis—over 30% plant nutrients

EXAMPLE: 20-20-20 or 83-0-0

XII. Types of fertilizers

A. Liquid--Fertilizer made by dissolving the correct proportion of the solid plant nutrient carriers into water; mav be in solution or suspension

INFORMATION SHEET

B. Dry mixed--Granulated fertilizer made by combining selected plant nutrient materials to obtain certain ratios and quantities of plant nutrients

C. Gas--Liquid fertilizer containing solid fertilizer materials which is dispensed under pressure and usually contains a higher analysis than clear liquid mixes

XIII. Comparing costs of fertilizer materials (Transparencies #18 & #19)

(Note: In comparing fertilizer prices, do it on the basis of cost per pound of nutrient, not on the cost per pound of fertilizer material.)

A. The formula for calculating cost per pound of nutrients is:

$$\frac{\text{Price of Fertilizer Per Pound of Material}}{\text{Guaranteed Percentage}}$$

Example: Fertilizer analysis — 20 - 10 - 10
Fertilizer cost -- $150.00/ton or 7.5¢ per pound

$$\frac{7.5¢/\text{pound}}{40\%} = 18.75¢/\text{lb. of nutrient}$$

B. Calculating cost of materials that contain only one nutrient

(Note: The same formula is used.)

Example: Fertilizer analysis -- 45 - 0 - 0 (Urea)

Fertilizer cost -- $240.00/ton or 12¢ per pound

$$\frac{12¢/\text{pound}}{0.45} = 26.6¢/\text{lb. of N}$$

XIV. Formulate a fertilizer blend (Transparency #20)

A. Needed information

1. Amount of nutrients to be applied

(Note: This refers to amount of nutrients and not to amount of fertilizer. Usually determined from a soil test report, past experience, or field man recommendation.)

2. Available fertilizers

INFORMATION SHEET

3. Method of application

EXAMPLE:

a. Want to apply 40 lbs. of nitrogen/acre, 40 lbs. P_2O_5/acre, and 20 lbs. of K_2O/acre

b. Available fertilizers

1) 34 - 0 - 0 (ammonium nitrate)

2) 18 - 46 - 0 (diammonium phosphate)

3) 0 - 0 - 60 (potassium chloride)

c. Formula for calculating fertilizer amount

$$\frac{\text{Amount of Nutrient to Apply/Acre}}{\text{\% Nutrient in Fertilizer Used}} = \text{Amount of Fertilizer To Apply Per Acre}$$

d. Steps to follow:

1) Potash requirements from potassium chloride

$$\frac{20 \text{ lbs./acre}}{.60} = 33 \text{ lbs./acre of 0-0-60}$$

2) Phosphate requirements from diammonium phosphate

$$\frac{40 \text{ lbs./acre}}{.46} = 87 \text{ lbs./acre of 18-46-0}$$

3) How much nitrogen would 87 lbs. of 18-46-0 supply?

87 lbs./acre X .18 = 16 lbs. N/acre

4) How much additional nitrogen is needed?

40 lbs. N/acre - 16 = 24 lbs. N needed

5) Additional nitrogen requirements from ammonium nitrate

$$\frac{24 \text{ lbs./acre}}{.34} = 71 \text{ lbs./acre of 34-0-0}$$

INFORMATION SHEET

6) Results:

87	lbs./acre of 18-46-0
71	lbs.acre of 34-0-0
33	lbs./acre of 0-0-60
191	lbs./acre total

XV. Methods of fertilizer application

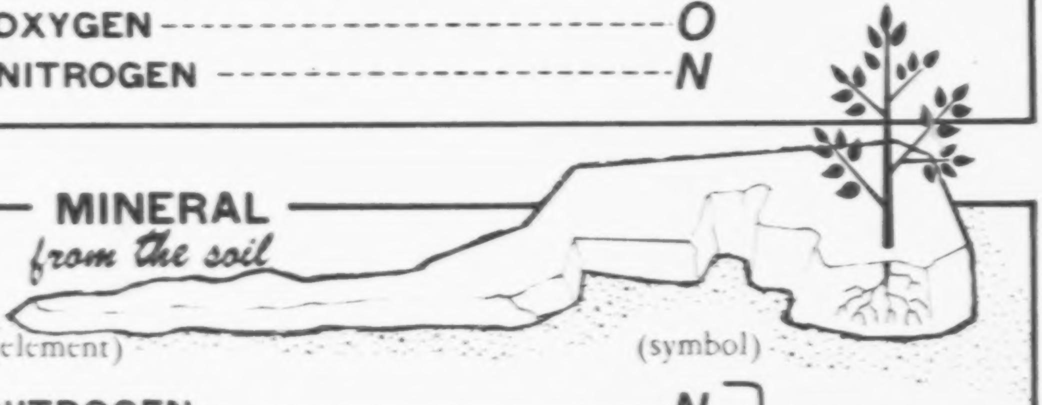
- A. Broadcast
  1. Truck mounted fertilizer spreader
  2. Trailer mounted fertilizer spreader
  3. Truck mounted liquid fertilizer applicator
  4. Field sprayer
  5. Aerial application
- B. Soil injection
  1. Anhydrous ammonia
  2. Nitrogen liquid solution under pressure
- C. Banding
  1. Dry fertilizer with planter
  2. Liquid or suspension fertilizer with planter
  3. Liquid or suspension with side dress application
- D. With irrigation water

CHEMICAL ELEMENTS ESSENTIAL TO PLANT GROWTH

NONMINERAL

from air and water

(element)	(symbol)
CARBON	C
HYDROGEN	H
OXYGEN	O
NITROGEN	N



MINERAL

from the soil

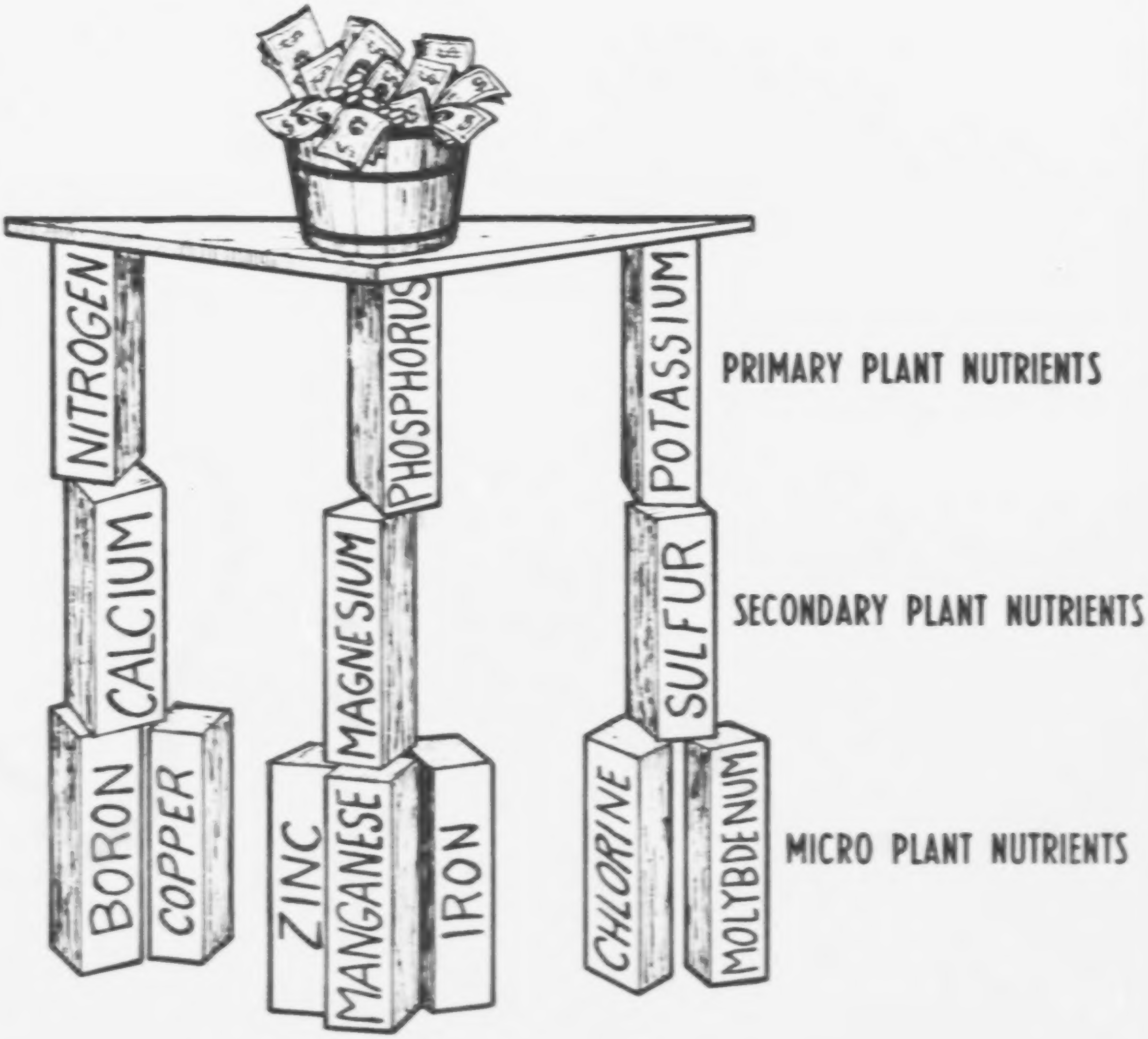
(element)	(symbol)	
NITROGEN	N	PRIMARY NUTRIENTS
PHOSPHORUS	P	
POTASSIUM	K	
CALCIUM	Ca	SECONDARY NUTRIENTS
MAGNESIUM	Mg	
SULFUR	S	
IRON	Fe	MICRO-NUTRIENTS
BORON	B	
MANGANESE	Mn	
COPPER	Cu	
ZINC	Zn	
MOLYBDENUM	Mo	
CHLORINE	Cl	

TEN ESSENTIAL ELEMENTS

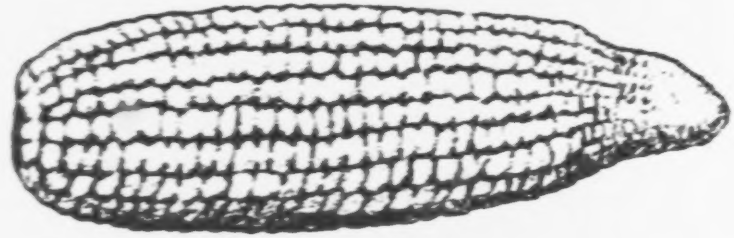
ESSENTIAL ELEMENT	SIMPLE SAYING
Carbon (C)	C.
Hydrogen (H)	H
Oxygen (O)	O
Phosphorus (P)	P
Potash (K)	K
Nitrogen (N)	N
Sulphur (S)	S
Calcium (Ca)	CA
Iron (Fe)	FE
Magnesium (Mg)	Mighty Good

C. HOPKNS CAFE Mighty Good

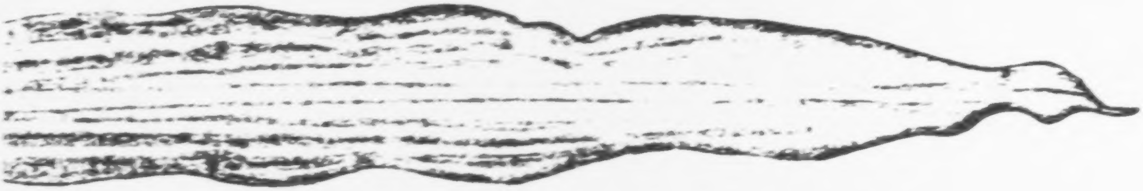
PROFITS CAN FALL IF ANY NUTRIENT IS SHORT


NITROGEN
PHOSPHORUS
POTASSIUM
PRIMARY PLANT NUTRIENTS
CALCIUM
MAGNESIUM
SULFUR
SECONDARY PLANT NUTRIENTS
BORON
COPPER
ZINC
MANGANESE
IRON
CHLORINE
MOLYBDENUM
MICRO PLANT NUTRIENTS

NITROGEN deficiency in corn

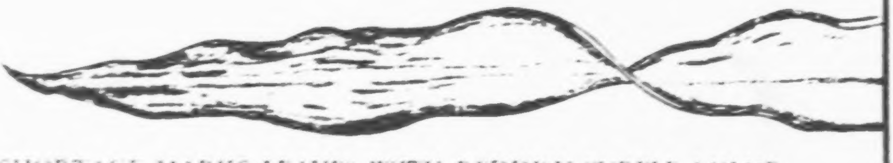


SMALL EARS AND LOW PROTEIN CONTENT
RESULT FROM N DEFICIENCY

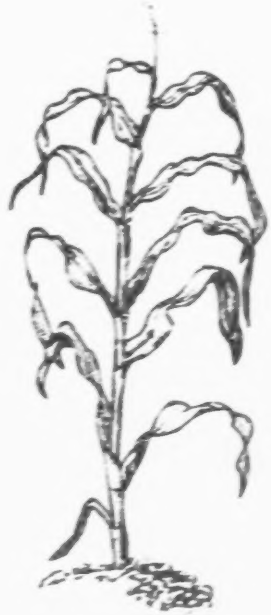


YELLOWING STARTS AT TIP AND MOVES
ALONG MIDDLE OF LEAF

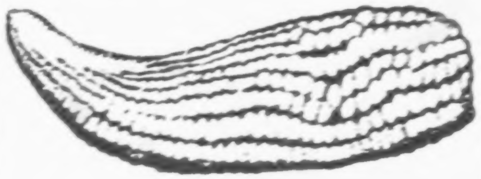
PHOSPHATE deficiency in corn



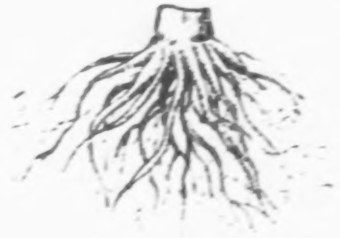
P SHORTAGE MARKS LEAVES WITH REDDISH-PURPLE COLOR



P CONTROLS STALK SIZE AND EAR SET. WHEN THERE'S A SHORTAGE, STALKS ARE WEAK, SPINDLY AND OFTEN BARREN OF EARS

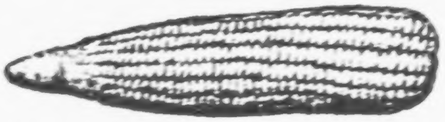


P IS NEEDED WHEN EARS ARE SMALL AND TWISTED AND KERNELS ARE UNDEVELOPED

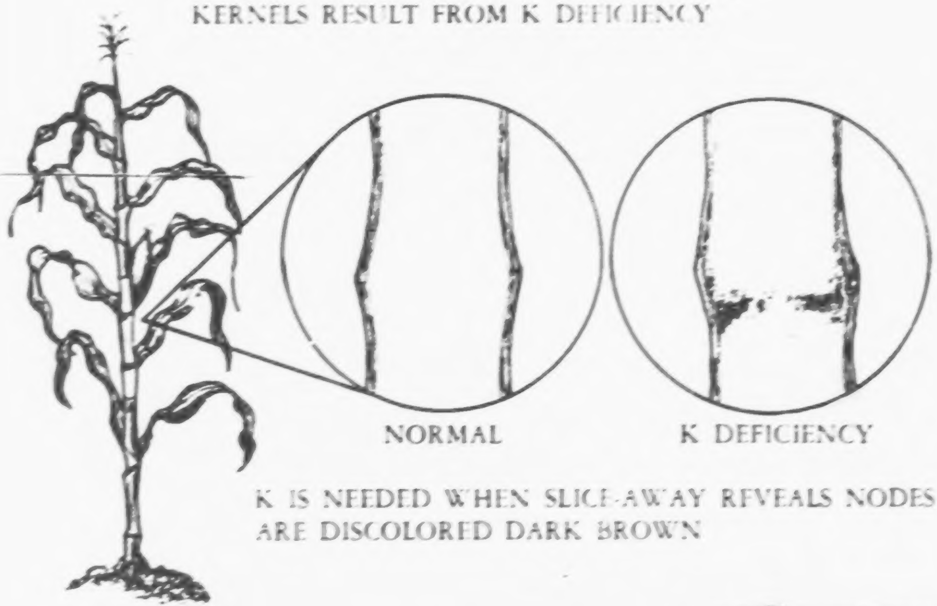


P SHORTAGE DURING EARLY WEEKS CAUSES A SHALLOW ROOT SYSTEM WITH LITTLE SPREAD

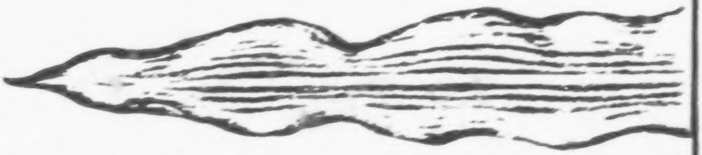
POTASH deficiency in corn



POORLY FILLED TIPS AND LOOSE CHAFFY KERNELS RESULT FROM K DEFICIENCY



K IS NEEDED WHEN SLICE-AWAY REVEALS NODES ARE DISCOLORED DARK BROWN

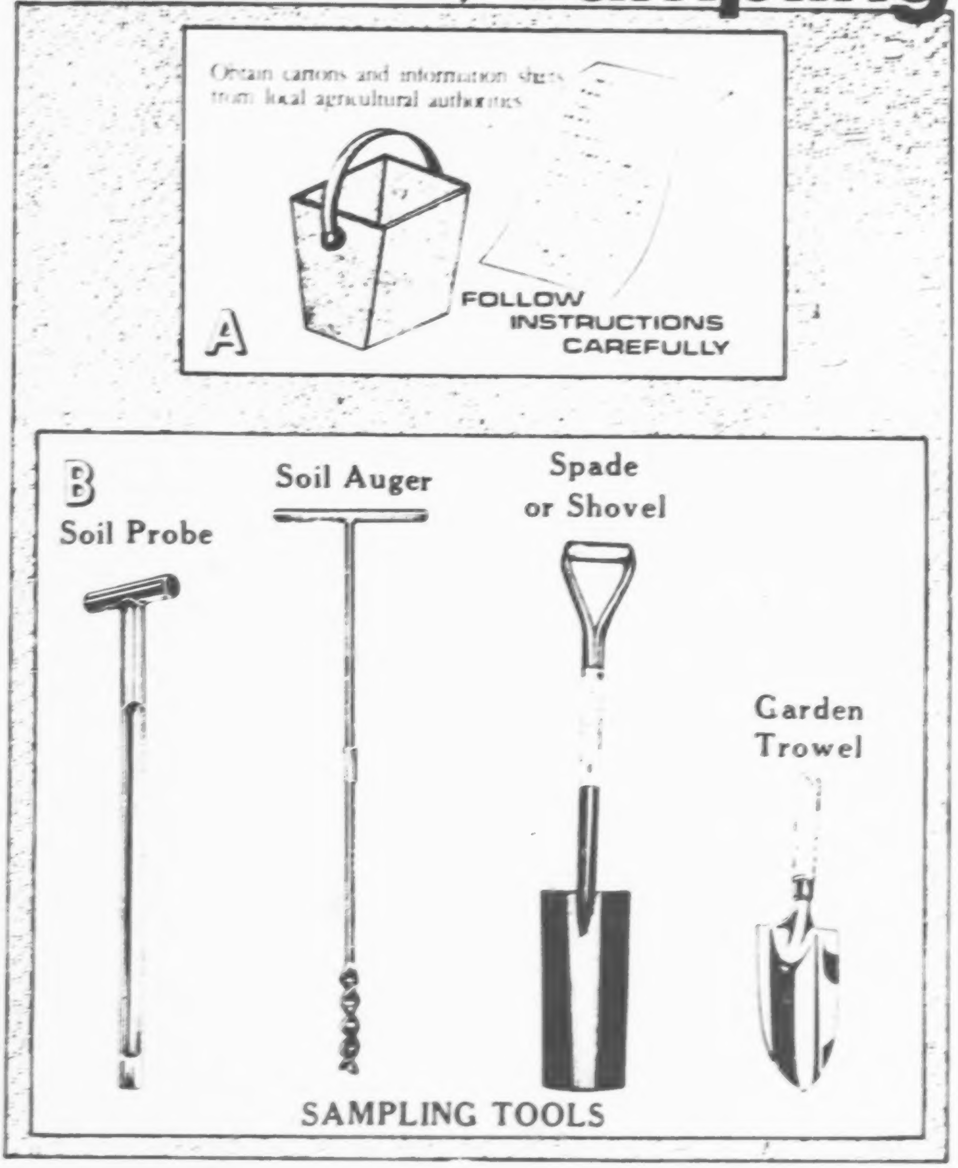


K DEFICIENCY CAUSES FIRING OR DRYING ALONG THE TIPS AND EDGES OF LOWEST LEAVES

Factors That Influence Fertilizer Use

1. Chemical condition of the soil
2. Physical condition of the soil
3. Crop to be grown
4. Climatic conditions
5. Time

SOIL → Sampling

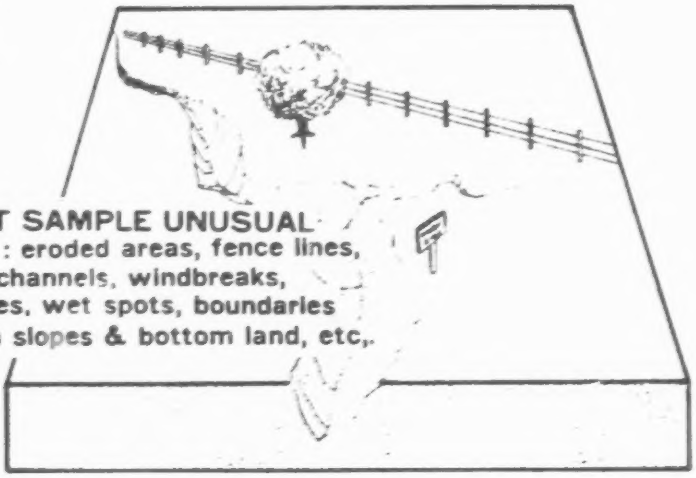

Obtain cartons and information sheets from local agricultural authorities

A
FOLLOW
INSTRUCTIONS
CAREFULLY
B
Soil Probe
Soil Auger
Spade
or Shovel
Garden
Trowel
SAMPLING TOOLS

BEST COPY AVAILABLE

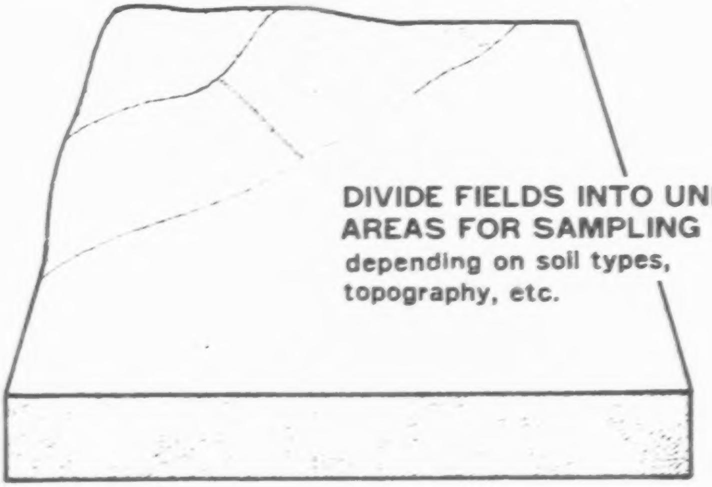
SOIL SAMPLING

C



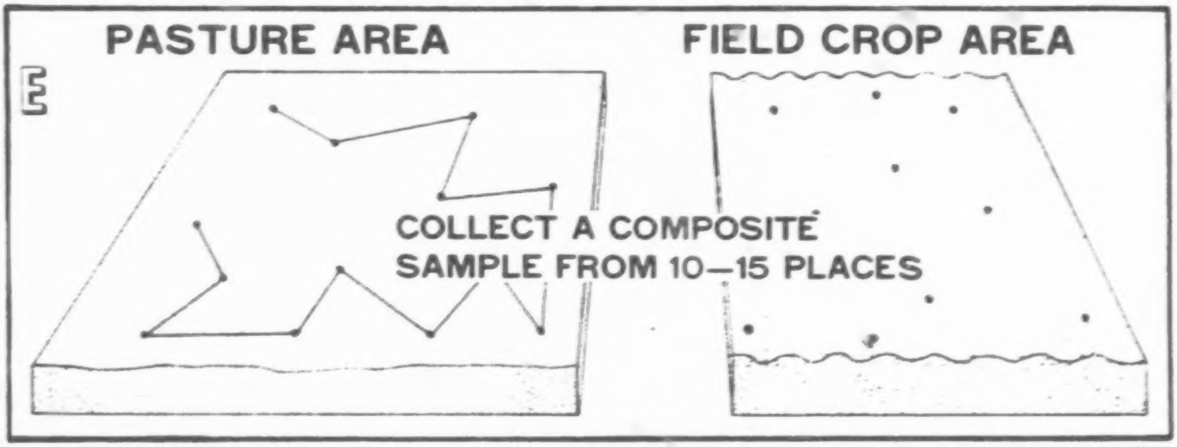
DO NOT SAMPLE UNUSUAL AREAS : eroded areas, fence lines, terrace channels, windbreaks, near trees, wet spots, boundaries between slopes & bottom land, etc,.

D

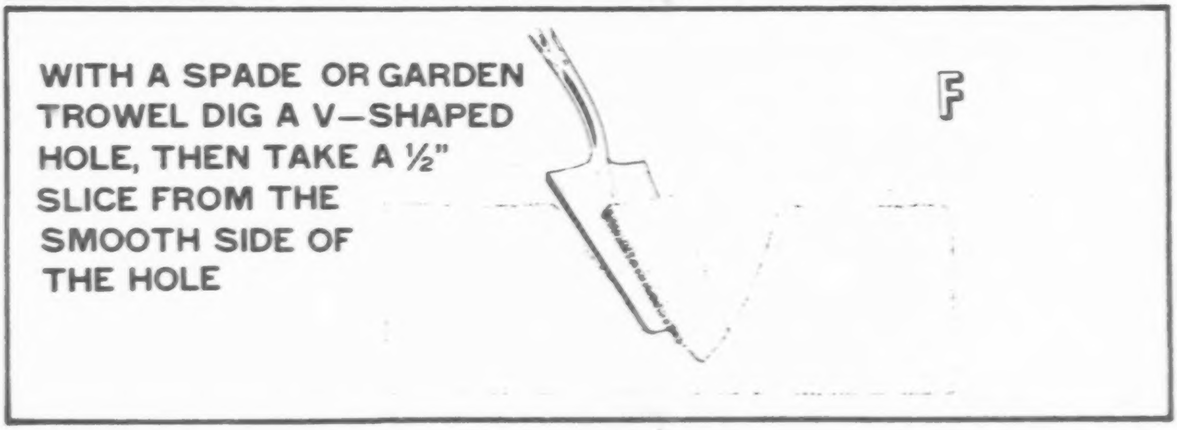


DIVIDE FIELDS INTO UNIFORM AREAS FOR SAMPLING depending on soil types, topography, etc.

SOIL SAMPLING

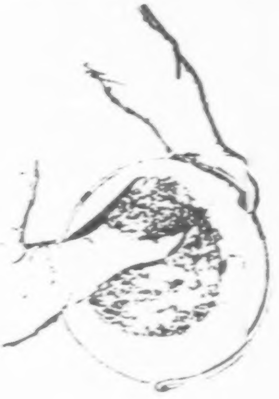

PASTURE AREA
FIELD CROP AREA
E

COLLECT A COMPOSITE SAMPLE FROM 10–15 PLACES



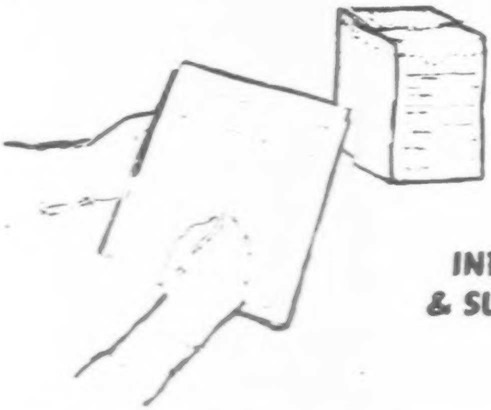
WITH A SPADE OR GARDEN TROWEL DIG A V–SHAPED HOLE, THEN TAKE A ½" SLICE FROM THE SMOOTH SIDE OF THE HOLE

SOIL SAMPLING



G

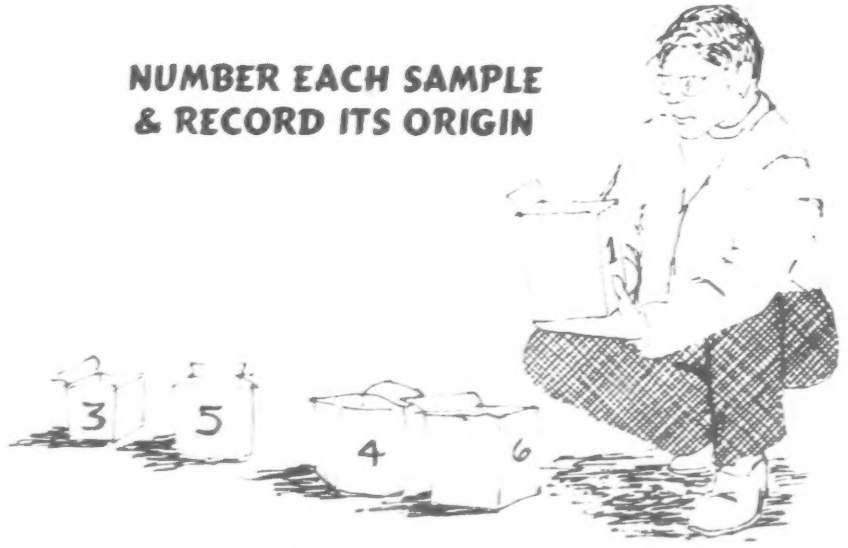
MIX SAMPLES IN A CLEAN CONTAINER



H

COMPLETE INFORMATION SHEET & SUBMIT WITH SAMPLE

SOIL SAMPLING



NUMBER EACH SAMPLE
& RECORD ITS ORIGIN

FOLLOW SOIL TEST RECOMMENDATIONS

Soil Sample Bag

1. Identify and number each sample before filling.
2. Fill soil sample bag 1/2 to 2/3 full with mixed soil from pail.
3. Securely close the bag.
4. Complete soil test report form by filling in field information section and checking the soils tests desired.
5. Send immediately to testing laboratory.

University of Idaho

COLLEGE OF AGRICULTURE
MOSCOW, IDAHO 83843

DATE: ____________________

NAME: ____________________

SAMPLE IDENTIFICATION:

____

____

____

LAB NO.
DO NOT WRITE IN THIS SPACE

SOIL SAMPLE

BEST COPY AVAILABLE

COOPERATIVE EXTENSION SERVICE
University of Idaho
College of Agriculture
In Cooperation with the
U.S. Department of Agriculture

TEACHING RESEARCH SERVICE

SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No.__________
Fee: $__________
Paid: Cash____ Check____ Other____

Name____________________
Address____________________

County__________
Date__________
Sample Ident.__________
Soil Texture__________
Acres Sampled__________
Sample Taken by__________ (grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop				
Previous crop				
Grown in 19___				
Grown in 19___				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☐

	Sampling depth	(inches)
	Cultivation or 0-7	Other
Soil Reaction - pH		
Available P (ppm P)		
Available K (ppm K)		
Soil Organic Matter, %		

NaHCO 1:20 NaOAc 1:5

B. Nitrogen Test

Soil depth (inches)	Nitrate ☐ nitrogen ppm N	Ammonium ☐ nitrogen ppm N	Available ☐ moisture (inches)
0-12			
12-24			
24-36			
36-48			
48-60			
60-72			
Total			

C. Cation Content ☐ Sample depth____

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

☐ Zinc ppm	☐ Manganese ppm	☐ Boron ppm	☐ Sulfate sulfur ppm	☐ Total Salts mmhos	☐ Gypsum Req. alkali soils	☐ Lime Req. acid soils	☐ Other

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				

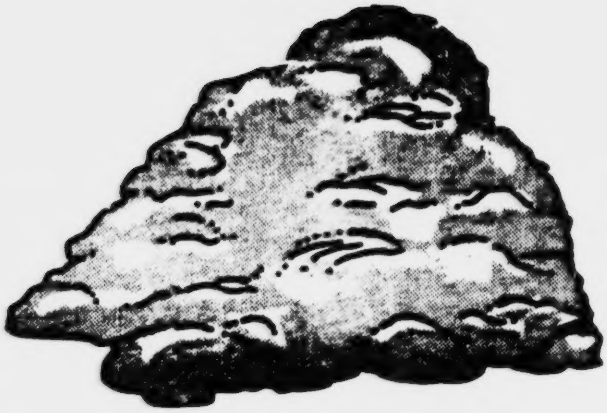
Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:____________________

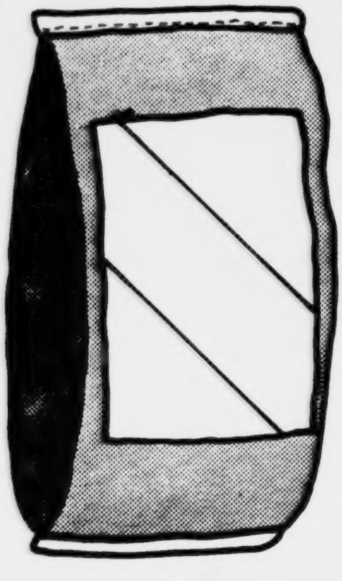
If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

____
Extension Agricultural Agent

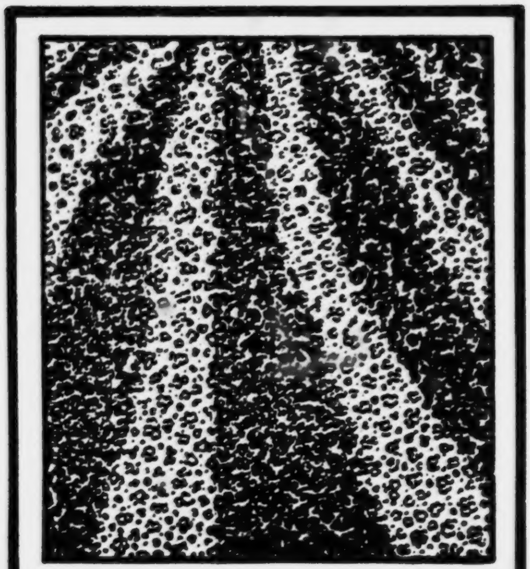
Nutrient Sources



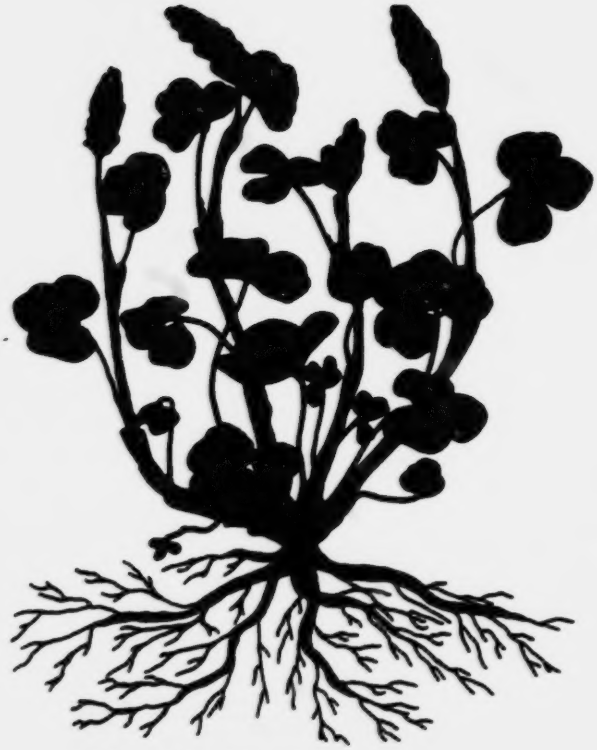
Animal manure



Commercial fertilizers

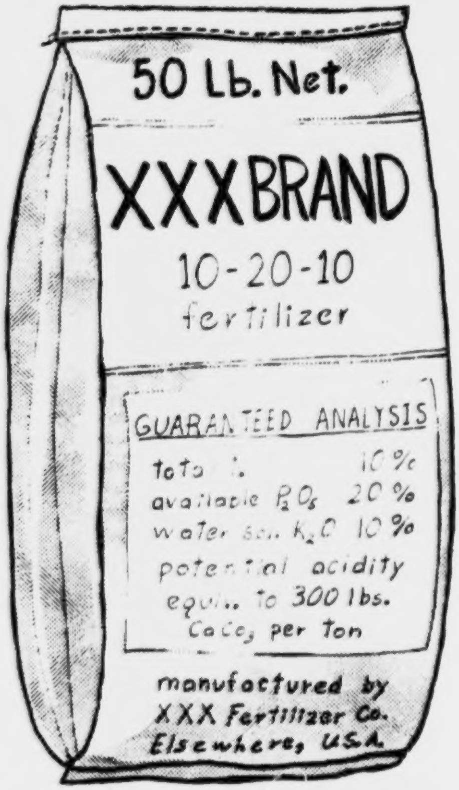


Crop residues



Green manure crop

INFORMATION COMMONLY FOUND ON A FERTILIZER BAG


50 Lb. Net.
XXXBRAND
10-20-10
fertilizer
GUARANTEED ANALYSIS
total N 10%
available P_2O_5 20%
water sol. K_2O 10%
potential acidity
equiv. to 300 lbs.
$CaCO_3$ per ton
manufactured by
XXX Fertilizer Co.
Elsewhere, U.S.A.

LBS. PER BAG

TRADE NAME OR BRAND

GRADE

GUARANTEED CHEMICAL COMPOSITION

ACID FORMING TENDENCY

NAME & ADDRESS OF MANUFACTURER

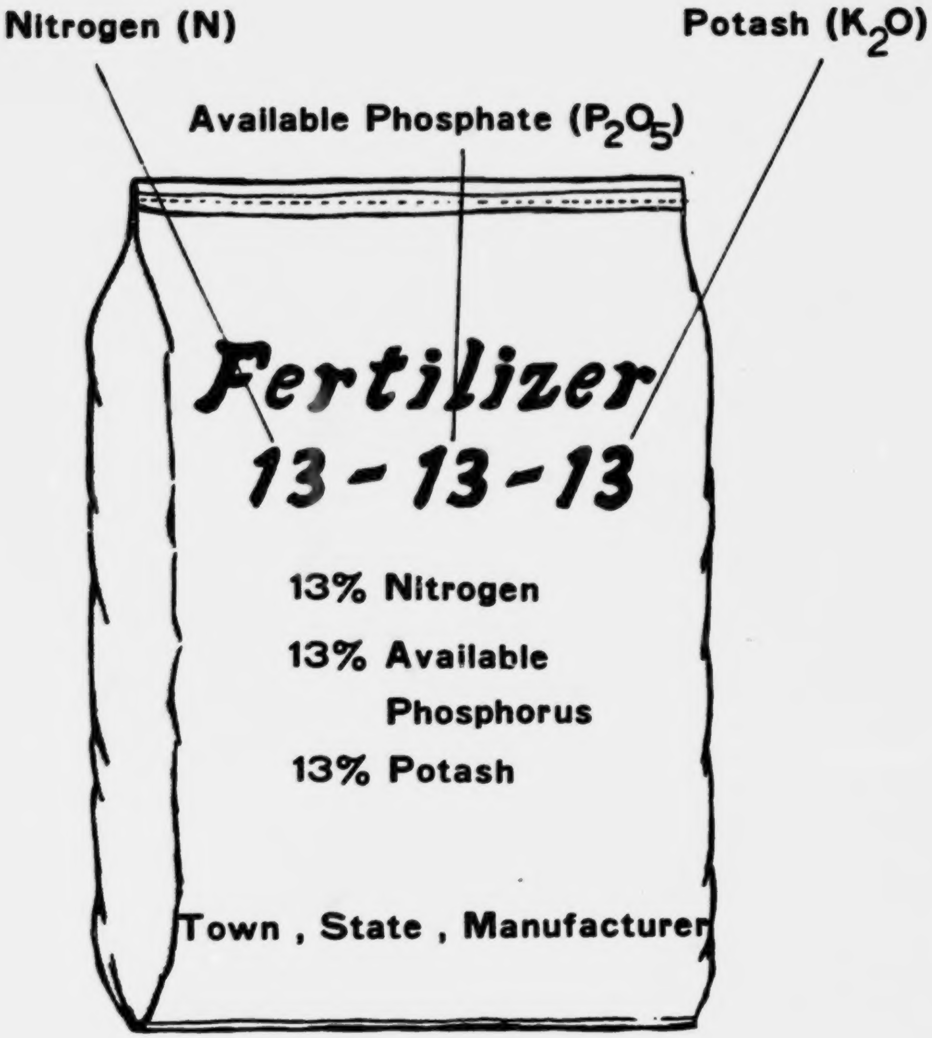
BEST COPY AVAILABLE

Fertilizer Analysis

20 - 10 - 10

20	10	10
↑	↑	↑
Total nitrogen available	**Total phosphorus expressed as P_2O_5**	**Water soluble potash expressed as K_2O**

PLANT NUTRIENT BLENDS


Nitrogen (N)
Potash (K_2O)
Available Phosphate (P_2O_5)
Fertilizer
13 - 13 - 13
13% Nitrogen
13% Available Phosphorus
13% Potash
Town , State , Manufacturer

13 N — 13 P_2O_5 — 13 K_2O = 1—1—1 Ratio

13 Lbs. of Each Primary Nutrient = 39 Lbs. per 100 Lbs. of Fertilizer

Compare Cost Per Pound of Nutrient, **Not** Cost Per Pound of Fertilizer!

$$\frac{\text{Price of fertilizer}}{\text{Net weight in lbs.} \times \text{Guaranteed \%}} = \begin{array}{c}\text{Price per pound}\\ \text{of nutrient}\end{array}$$

Calculate Amount of Fertilizer to Apply

$$\frac{\text{Amount to apply per acre}}{\text{\% nutrient in fertilizer}} = \text{Amount of fertilizer to apply per acre}$$

SOIL FERTILITY
UNIT 2

ASSIGNMENT SHEET #1 - CALCULATE NUMBER OF POUNDS OF ACTUAL NITROGEN, PHOSPHORUS, AND POTASSIUM AVAILABE FROM DIFFERENT FERTILIZER ANALYSES

Name____Score______________

Compare the pounds of actual nitrogen, phosphorus, and potassium available for each fertilizer. Use 80# as a base for all problems. When you have complete the problems, turn into your instructor for evaluation.

A. Fertilizer analysis 10-20-10 ______ N ______ P ______ K

B. Fertilizer analysis 18-46-0 ______ N ______ P ______ K

C. Fertilizer analysis 13-0-44 ______ N ______ P ______ K

D. Fertilizer analysis 82-0-0 ______ N ______ P ______ K

E. Fertilizer analysis 0-45-0 ______ N ______ P ______ K

SOIL FERTILITY
UNIT 2

ASSIGNMENT SHEET #2 - CALCULATE COST PER POUND OF NITROGEN FOR DIFFERENT FERTILIZER ANALYSES

Name____Score______________

Compare the cost per pound of actual nitrogen for each fertilizer. When you have completed the problems, turn into your instructor for evaluation. Ask instructor for the local price per ton of each analysis.

1. Ammonium nitrate 33.0% Local price per ton______________

2. Anhydrous ammonia 82.0% Local price per ton______________

3. Urea 45.0% Local price per ton______________

4. Ammonium sulphate 21.0% Local price per ton______________

SOIL FERTILITY
UNIT 2

ASSIGNMENT SHEET #3 - CALCULATE APPLICATION RATES OF FERTILIZERS

Name______________________________Score____________

Calculate the amount of nutrients needed using the different fertilizer analyses. When completed, return to instructor for evaluation.

A. A farmer desires to plant wheat with an application of 100 lbs. phosphate per acre with a 0-20-0 analysis. How many pounds of fertilizer would be needed?

B. How many pounds of 0-0-60 would be needed to apply 40 lbs. of K_2O per acre?

C. How many pounds of 82-0-0 would be needed to apply 100 lbs. of N per acre?

SOIL FERTILITY
UNIT 2

ASSIGNMENT SHEET #4 - FORMULATE A FERTILIZER BLEND, CALCULATE TOTAL COST AND COST PER ACRE

Name____Score_______________

You are raising 40 acres of silage corn. Following a soil test, you and the county agent determine that you need to apply 80 lbs. N per acre, 40 lbs. of P per acre, and 10 lbs. of Potassium per acre. The fertilizers available at the local cooperative are: (1) Urea 46-0-0 at $184.00 per ton, (2) Diammonium phosphate 18-46-0 at $192.00 per ton, and (3) Potassium Chloride 0-0-60 at $120.00 per ton.

A. Formulate a fertilizer blend, using the available fertilizers, that will meet your requirements.

B. What will be the total cost per acre using your fertilizer blend?

C. What will be the total cost for 40 acres using your fertilizer blend?

SOIL FERTILITY
UNIT 2

ASSIGNMENT SHEET #5 - COMPLETE A SOIL TEST REPORT FORM

Name____Score_______________

Secure a soil sample and answer the necessary information concerning the crop to be grown and the cropping history of the plot. Check the type of soil test desired. Have the sample analyzed. Using fertilizers available in your community and local prices, recommend the fertilizers to use and the amount. When completed, return to instructor for evaluation and discussion purposes.

(Note: Soil Test Report Forms, fertilizer guides and instructions may be obtained from your local cooperative extension agent.)

Available Fertilizers	Cost/Ton	Amount Required	Total Cost
1.			
2.			
3.			
4.			

SOIL FERTILITY
UNIT 2

ANSWERS TO ASSIGNMENT SHEETS

1. a. 8# N, 16# P, 8# K
   b. 14.4# N, 36.8# P, 0# K
   c. 10.4# N, 0# P, 35.2# K
   d. 65.6# N, 0# P, 0# K
   e. 0# N, 36# P, 0# K

2. Cost will vary according to local cost of fertilizers

3. a. 200 lbs. of 0-20-0
   b. 67 lbs. of 0-0-60
   c. 122 lbs. of 82-0-0

4. a. 17# of 0-0-7- (potassium chloride)
   87# of 18-46-0 (diammonium phosphate)
   139# of 46-0-0 (urea)
   243# of fertilizer per acre

   b. 17# of 0-0-60 @ .06¢/lb. = $1.02
   87# of 18-46-0 @ .10¢/lb. = $8.70
   139# of 46-0-0 @ .09¢/lb. = $12.51
   Cost per acre = $22.23

   C. $22.23 X 40 acres = $889.20

5. Evaluated to satisfaction of instructor

SOIL FERTILITY
UNIT 2

TEST

Name____Score____________

1. Match terms associated with soil fertility to the correct definitions. Write the correct numbers in the blanks.

    1. Essential nutrient
    2. Deficiency
    3. Symptom
    4. Fertilizer
    5. Analysis
    6. Brand
    7. Complete fertilizer

_____a. Natural, manufactured or processed materials or mixture of materials that contains one or more of the essential nutrients; available in dry, liquid or gaseous form

_____b. Plant condition where an essential nutrient is not sufficiently available

_____c. Percentage water soluble content of nitrogen (N), phosphorus (P) expressed as P_2O_5 and potassium (K) expressed as K_2O in the fertilizer

_____d. Trademark of the company which produced the fertilizer

_____e. A visual sign or condition that results from a deficiency

_____f. Fertilizer which supplies all three of the primary nutrients (N, P, K)

_____g. Elements that are necessary for plant growth and reproduction, e.g. nitrogen, phosphorus and potassium

2. Classify the following essential nutrients as primary (P), secondary (S), or micronutrient (M). Write the correct letters in the blanks.

_____a. Sulphur (S)

_____b. Potassium (K)

_____c. Zinc (Zn)

_____d. Nitrogen (N)

_____e. Calcium (Ca)

TEST

_____f. Phosphorus (P)

_____g. Boron (B)

_____h. Molybdenum (Mo)

_____i. Iron (Fe)

_____j. Magnesium (Mg)

3. Match the functions of nutrients for crop growth to the correct nutrient. Write the correct numbers in the blanks.

   1. Nitrogen (N)
   2. Phosphorus (P)
   3. Potassium (K)
   4. Sulphur (S)
   5. Calcium (Ca)
   6. Magnesium (Mg)

_____a. Gives dark green color to plant; promotes rapid growth; increases protein and yeilds; aids and promotes seed development

_____b. Speeds decay of organic matter; stimulates formation of nitrates; promotes root and leaf growth; is necessary for nodulation of legumes

_____c. Is necessary for production and translocation of carbohydrates; produces plumper seed; controls water intake and respiration; stiffens straw and stalks

_____d. Is necessary for chlorophyll or green plant color; increases absorption of phosphorus; aids in formation of fats and oils; is important in plant enzyme system

_____e. Important to germinating seedlings; contributes to early maturing crops; is necessary for seed and fruit formation; stimulates root growth

_____f. Is necessary for nodule formation on legumes; is associated with plant enzyme systems; stimulates seed production; affects protein and crop quality

4. Match nutrients to the correct deficiency symptoms. Write the correct numbers in the blanks.

   1. Nitrogen
   2. Phosphorus
   3. Potassium
   4. Sulphur
   5. Magnesium

TEST

_____a. Stunted and spindly; yellow, yellowish-green, or light green color in foliage; older leaves affected first

_____b. Stunted growth; very dark green color; purple leaves in advanced stages; older leaves affected first

_____c. Shorter plants; bronzing or browning of leaf color; lodging occurs

_____d. Young plants stunted; leaves light green to yellow color; stems are thin and spindly

_____e. Leaf parts between veins show a whitish color; interveinal chlorosis; leaves curl upward along margins

5. Select from the following list factors that influence the use of fertilizers. Write an "X" in the blank before each correct answer.

_____a. Fertility of soil

_____b. Crops

_____c. Physical condition of soil

_____d. Insects and diseases

_____e. Climatic conditions

_____f. Time

6. Discuss the major points in collecting and handling a representative soil sample.

____

____

____

____

____

____

____

____

____

TEST

7. Using the following information for irrigated field corn, calculate the pounds of nitrogen to apply per acre. Show all work.

   A. Field information

      1. Soil pH--6.7

      2. Available total N--15 ppm (0-24" depth)

      3. Previous crop--Barley; 3 tons/acre residue returned

   B. Nitrogen fertilizer rated based on N soil test

N soil test (0-24" depth) N (ppm)	N application * (lb. N/acre)
0	160
10	120
20	80
30	40
over 40	0

* Add 20 lb. N for each ton of grain straw plowed under up to 50lb. N/acre.

   C. Pounds of N to apply per acre________________________

____

____

____

8. Discuss the major points in collecting and handling a representative plant tissue sample.

____

____

____

____

____

____

TEST

9. List fours sources of nutrients.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

10. Select from the following list information that must be stamped on all fertilizer bags according to state law. Write an "X" in the blank before each correct answer.

_____a. Net weight

_____b. Name, brand or trademark

_____c. Cost per pound

_____d. Name and address of manufacturer

_____e. Guaranteed analysis

11. Match the fertilizer analyses to the correct description. Write the correct numbers in the blanks.

1. High analysis
2. Ordinary analysis
3. Concentrated analysis

_____a. Over 30% plant nutrients

_____b. 20 to 30% plant nutrients

_____c. Less than 20% plant nutrients

12. Match the types of fertilizers to the correct description. Write the correct numbers in the blanks.

1. Liquid 2. Dry mixed 3. Gas

_____a. Granulated fertilizer made by combining selected plant nutrient materials to obtain certain ratios and quantities of plant nutrients

_____b. Liquid fertilizer containing solid fertilizer materials which is dispensed under pressure and usually contains a higher analysis than clear liquid mixes

_____c. Fertilizer made by dissolving the correct proportion of the solid plant nutrient carriers into water; may be in solution or suspension

TEST

13. By calculating cost per pound of nitrogen for each of the following fertilizers, determine which is the cheapest source of nitrogen. Show all work.

    A. 34-0-0 (ammonium nitrate) at $122/ton

    ____

    ____

    B. 82-0-0 (anhydrous ammonia) at $160/ton

    ____

    ____

    ____

    C. Cheapest source of N is ______________________

14. Formulate a fertilizer blend using the following information. Show all work.

    A. Amount of nutrients to apply per acre

        1. 100 lbs. nitrogen

        2. 150 lbs. phosphate

    B. Available fertilizers

        1. 46-0-0 (Urea)

        2. 18-46-0 (Diammonium phosphate)

    C. Amount of fertilizer to apply

        1. Urea ________

        2. Diammonium phosphate ________

        3. Total amount applied/acre ________

    D. Calculations ________________________________

    ____

    ____

TEST

15. List three methods of fertilizer application.

a. ______________________________

b. ______________________________

c. ______________________________

SOIL FERTILITY
UNIT 2

ANSWERS TO UNIT TEST

1. a. 4
   b. 2
   c. 5
   d. 6
   e. 3
   f. 7
   g. 1

2. a. S
   b. P
   c. M
   d. P
   e. S
   f. P
   g. M

3. a. 1
   b. 5
   c. 3
   d. 6
   e. 2
   f. 4

4. a. 1
   b. 2
   c. 3
   d. 4
   e. 5

5. a, b, c, d, e, f

6. Discussion should include: (1) steps involved in taking a good soil sample, (2) materials needed to collect sample, (3) when to take sample, (4) sampling area, (5) collecting a representative sample, (6) where to send sample to be tested, and (6) how often to test soil.

7. 100 lbs. N/acre from soil test
   50 lbs. N/acre for incorporated residue
   150 lbs. N/acre total needed

8. Discussion should include: (1) collecting plant tissue samples, (2) handling of plant tissue samples, and (3) interpretation of results of plant tissue analysis.

9. a. Animal manure
   b. Crop residues
   c. Green manure crops
   d. Commercial fertilizers

ANSWERS TO TEST

10. a, b, d, e

11. a. 3, b. 1, c. 2

12. a. 2, b. 3, c. 1

13. A. 18¢/lb. of N

    B. 10¢/lb. of N

    C. 82-0-0 (anhydrous ammonia)

14. 1. 89# of 46-0-0

    2. 326# of 18-46-0

    3. 415# total amount applied/acre

15. Answers to include three of the following:

    a. Broadcast

    b. Soil Injection

    c. Banding

    d. With irrigation water

IRRIGATION
UNIT 3

UNIT OBJECTIVE

After completing this unit, the student should be able to list the components of different irrigation systems. The student should be able to determine water intake rates, available moisture and calculate irrigation frequency. The student should be able to discuss factors that affect the selection of irrigation systems. This knowledge will be shown by completing assignment sheets, job sheets, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with irrigation to the correct definitions.
2. List three reasons for irrigating.
3. Select from a list factors that affect water intake rates.
4. Calculate the total available moisture of a soil.
5. Name three methods used for estimating soil moisture in the crop root zone.
6. Calculate days remaining until next irrigation.
7. Name two units of volume measurement, and two units of flowrate measurement of water.
8. Convert units of water measurement.
9. Name three devices for measuring water in motion.
10. Name four types of irrigation systems.
11. Match the basic parts of a surface irrigation system to the correct definition.
12. Match the basic parts of sprinkler irrigation system to the correct definition.
13. Select from a list factors that affect the selection of irrigation systems.

IRRIGATION
UNIT 3

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit.

      1. Literature

         a. Planning for an Irrigation System, a paperback discussing different irrigation systems; available from AAVIM, 120 Engineering Center, Athens, GA 30602.

         b. Farm Drainage, instructional package, 10 pages notes, 26 transparencies, available from: Hobar Publications 1234 Tiller Lane, St. Paul, MN, 55112.

      2. Filmstrips, slideshows, etc.

         a. Irrigation, 6 cassettes, 6 filmstrips and study guide, available from: Teaching Aids, Inc., P. O. Box 1798, Costa Mesa, CA, 92626; approximate cost $229.00, order no. B263.

         b. The Irrigation System Explained, 6 filmstrips and 6 cassettes, available from: Agrimedia Corporation, Garden City, NY, 11530; approximate cost $154.00, order no. 401

      3. Films

   B. Make transparencies

   C. Provide students with objective sheet

   D. Provide student with information and assignment sheets

   E. Discuss unit and specific objectives

SUGGESTED ACTIVITIES

- F. Discuss information and assignment sheets
- G. Give test
- H. Reteach if necessary
- I. Retest

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Transparency masters
    1. TM 1--Soil texture and water intake rates
    2. TM 2--Average water holding capacity of soils representing different textural classes
    3. TM 3--Effective root zones of common crops
    4. TM 4--Soil moisture scheduling procedure
    5. TM 5--Crop stress point
    6. TM 6--Units of water measurement
    7. TM 7--Conversion of units of water flow
    8. TM 8--Equivalent rate of flow
    9. TM 9--Types of weirs
    10. TM 10--Types of flumes
    11. TM 11--Types of flowmeters
    12. TM 12--Parts of a surface irrigation system
    13. TM 13--Level systems of surface irrigation
    14. TM 14--Graded systems of surface irrigation
    15. TM 15--Parts of a sprinkler irrigation system
    16. TM 16--Common types of sprinklers

SUGGESTED ACTIVITIES

17. TM 17--Types of sprinkler irrigation systems

18. TM 18--Factors that affect the selection of irrigation systems

19. TM 19--Comparision of investment costs for irrigation systems

E. Assignment sheets

1. AS 1--Calculate total available moisture

2. AS 2--Calculate days till next irrigation

3. AS 3--Calculate irrigation length

4. AS 4--Convert units of water measurement

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Turner and Anderson, Planning for an Irrigation System. Second edition, Athens, Georgia, American Association for Instructional Materials, 1980.

B. Marr, James C., Furrow Irrigation, Manual No. 37, Berkelv, CA, Agricultural Publications, University of California at Berkely, 1967.

C. Pair, Hinz, Reid, and Frost, Sprinkler Irrigation, 47th edition, Silver Springs, Maryland, Sprinkler Irrigation Association, 1975.

D. Crops, Soils, and Fertilizer Resource Manual, Vo-ed No. 73, Moscow, ID, University of Idaho, Dept. of Agricultural Education, 1978.

IRRIGATION
UNIT 3

INFORMATION SHEET

I. Terms and definitions

A. Irrigation--To supply land with water by means of ditches, sprinklers, or other system

B. Soil texture--A name given a textural group based on the relative proportions of the soil separates (sand, silt, clay)

C. Soil structure--The combination and arrangement of soil particles (sand, silt, clay) into aggregates

D. Slope--A measurement of difference in elevation from one point to another; it is generally referred to as percent - the number of feet difference in elevation for 100 feet of horizontal distance

E. Water table--The level at which the soil is saturated with water; usually below the soil surface

F. Soil profile--A vertical cross-section of the soil from the surface through all its horizons

G. Root zone--That part of the soil profile from which growing plants can utilize water and nutrients

H. Irrigation frequency--The number of days between irrigations

I. Weir--An obstruction placed in a stream or channel diverting the water through a device to measure the flow of water; types include rectangular, cipolleti, and v-notch

J. Measuring flume--Chute placed in a stream or channel to measure the flow of water

K. Flowmeter--A device used for measuring water flow from a well or pipeline

L. Corrugate--A series of parallel furrows commonly used in surface irrigation systems to direct the flow of water between seedbeds

M. Ditch--Channel for carrying water; for drainage or irrigation of the soil

INFORMATION SHEET

II. Reasons for irrigating

A. Provide water for crops in the right amount at the right time

(Note: Some areas have sufficient yearly rainfall, but it does not come when the crop needs it most. Crops suffer because the time between rainfalls is too long, drought conditions occur, plants suffer and yields decrease.)

B. Increase crop yield

(Note: Reasons that yields increase when ample water is available from irrigation are (1) better assurance of a good stand, (2) more plants per acre can be grown, (3) more efficient use of fertilizer, and (4) improved varieties can be planted.)

C. Improved crop quality

(Note: Many examples from research and experience can be cited to show that irrigation improves quality. Fruit is larger and more uniform in size. Ears of corn are more uniform and you get a larger percentage of No. 1 potatoes.)

III. Soil properties that affect water intake rates

A. Soil texture (Transparency #1)

1. Coarse sand - 0.75-1.00"/hr.

2. Fine sands - 0.50-0.75"/hr.

3. Fine sandy loams - 0.35-0.50"/hr.

4. Silt loams - 0.25-0.40"/hr.

5. Clay loams - 0.10-0.30"/hr.

B. Soil structure

(Note: Soil Structure plays an important part in the productivity of different soils, affecting the ease with which roots can penetrate, the water intake rate and the movement of water in the soil.)

C. Slope

(Note: As the slope of a field increases, the chance for the water to run off before entering the soil increases.)

INFORMATION SHEET

D. Other factors

1. Presence of impermeable layer in soil profile

2. General tilth of surface soil

3. Moisture content of the soil profile

IV. Total available moisture of the soil (Transparency #2)

A. The amount of water that can be held in the soil which is available for crop use

(Note: The soil profile is much like a sponge, the sponge having the capability to absorb water. Like the soil profile, the sponge has a saturation point where it cannot absorb any more water.)

1. Factors that affect total available moisture

a) Texture of surface and subsurface horizons

b) Depth of the soil profile

(Note: If a layer is present in the soil profile which is impenetrable to water, air, and roots, the soil depth would be that part of the profile above this layer.)

B. Information needed to calculate the total available moisture for a crop growing in a soil

1. Soil type

2. Water holding capacity of that soil type

3. Root zone depth (Transparency #3)

EXAMPLE: A crop, alfalfa, is growing in a loamy textured soil which has a water holding capacity of 1.69 inches of moisture per foot. The average root zone is four feet. What is the total available moisture of the root zone?

1.69"/foot X 4' root zone = 6.75" moisture in the root zone

INFORMATION SHEET

V. Estimate soil moisture in crop root zone

A. Plant and field methods--Crop stress point is determined by the plant showing signs of moisture stress

(Note: Plant symptoms that indicate moisture stress include wilted leaves and color change in leaves. By the time symptoms are noticeable, considerable damage has been done to plant. This is not a recommended procedure for determining soil moisture.)

B. Feel method for estimating soil moisture

(Note: The use of this method of determining soil moisture requires much experience for the results to be very accurate. A pamphlet is available from the University of Idaho College of Agriculture, miscellaneous series #39, that describes soil types, percent available moisture and characteristics of each for a ball test, ribbon test, and open-palm test. This method can be acceptable once fingertips are "calibrated".)

C. Tensiometers--Are mechanical devices placed at several representative places in a field to measure soil moisture

(Note: Tensiometers are usually placed at two depths in the root zone. This is an accurate way of determining soil moisture to guide you in irrigation scheduling.)

VI. Soil moisture scheduling procedure (Transparency #4)

A. Determine total available moisture of crop root zone

Example: Potatoes on silt loam soil

1. Root zone dept (from Table 1) - 2.0 ft.

Table 1
Effective Crop Root Zone Depth (no soil barriers)

Crop	Depth (ft.)
Alfalfa	4.0
Beans	2.0
Field Corn	3.0
Sweet Corn	2.5
Mint	2.0
Onions	1.5
Potatoes	2.0
Small grains	3.5
Sugar Beets	3.0
Peas	2.0
Pasture	2.0

INFORMATION SHEET

2. Available water-holding capacity of the soil (from Table 2) = 2.2 inches/ft.

Table 2
Average Available Water Holding Capacity of Soils

Soil Type	inches/ft.
Sand	1.0
Sandy Loam	1.5
Loam, silt loam, clay	2.2

3. Total available moisture of crop root zone - 2 ft. X 2.2 inches/ft. = 4.4 inches

B. Determine present soil moisture available for crop use

1. Determine present soil moisture

(Note: When using feel method, use soil auger to check moisture in crop root zone. Estimate soil moisture in 1 foot increments. Or obtain information from reading on tensiometer to determine average of crop root zone.)

Example: Potato field monitored on July 25. Soil moisture determinations indicate there is 80% available moisture in the first foot, 90% in the second foot or a crop root zone average of 85%.

2. Crop stress point (From Table 3) - 65% (Transparency #5)

Table 3
Crop Stress Point or Percent Moisture
Remaining at Irrigation

Crop	Season	First Irrigation	Later Irrigation
Potatoes	65	65	50 (at vine kill)
Sugar beets	50	50	50
Sweet corn	60	40	60
Field corn	50	40	50
Mint	60	60	60
Beans	60	60	60
Small grains	40	40	60 (from boot stage through flowering)
Onions	70	60	70
Alfalfa hay	50	50	50
Pasture	50	50	50

3. Percent moisture remaining for plant use:
   85 - 65 = 20%

   (Note: In this example, 100% available moisture is equivalent to 4.4 inches of water. Therefore, the amount of water remaining for plant use: 4.4 inches X 20% = 0.88 inches).

C. Estimate crop water use

1. Find water use (E_t) from estimated crop water use table in newspaper

   (Note: E_t = evapotranspiration loss of water from the soil both by evaporation and by transpiration from the plants, or crop water use. For more information contact your county agent, fieldman or irrigation consultant.)

   Example: E_t for potatoes on July 25 of 0.27 inches/day

D. Calculate days remaining until next irrigation

Example: 0.88 - 0.27 = 3.3 days; therefore the next irrigation should be July 28

VII. Units of water measurement (Transparency #6)

A. Volume measure

1. Gallons
2. Acre-inches--Amount of water required to cover one acre one inch deep (27,154 gallons)
3. Acre-feet--Amount of water required to cover one acre one foot deep (325,850 gallons)

B. Flow rate

1. Gallons per minute
2. Cubic feet per second
3. Miner's inch

INFORMATION SHEET

VIII. Conversion of units of water measurement (Transparencies #7 and #8)

1 gallon = 231 cubic inches = 8.33 lbs

1 cubic foot = 7.48 gallons = 62.4 lbs

1 acre foot = 43,560 cubic feet
= 325,850 gallons
= 12 acre inches

1 acre inch = 27,154 gallons
= 8,630 cubic feet

1 gallon per min. = 0.00223 cubic feet per second

1 cubic ft. per second = 7.48 gallons per second
= 450 gallons per minute
= 646.272 gallons per day (24 hours)
= 1.983 acre ft. per day (24 hours)
= 50 miner's inches in Idaho

IX. Common measuring devices for water in motion

A. Weirs (Transparency #9)

1. Rectangular weirs

(Note: Originally used but aren't very accurate because the deeper the head of water, the greater the pressure and flow of water over the crest of the weir.)

2. Cipolleti weirs

(Note: angle of side walls compensates for the pressure due to additional height of water coming over the wier. This is the most accurate and is most commonly used.)

3. V-Notch weirs

(Note: This weir is relatively accurate but not a common weir. It is used mainly to measure small streams which come from small pumps.)

B. Flumes (Transparency #10)

1. Cutthroat

2. Parshall

3. Trapezoidal

INFORMATION SHEET

- C. Flow meters (Transparency #11)

X. Types of irrigation systems

- A. Surface
- B. Sprinkler
- C. Trickle
- D. Subsurface

XI. Surface irrigation (Transparency #12)

- A. Water is applied on the ground at the ground level; it flows by gravity over the surface of the fields
- B. Basic parts of a surface irrigation system
    1. Supply of water

       (Note: Common sources of water include: farm ponds, rivers, canals, and wells)
    2. Field supply line -- It is the means by which water is delivered from the source to the field; it may be an open ditch or a pipeline

       (Note: The ditch may be unlined or lined with such materials as concrete, asphalt, or plastic. The most commonly used materials for pipelines are steel, aluminum, plastic, asbestos cement and concrete.)
    3. Head ditch or head pipeline -- It is the means by which water is made available from the field supply line to the different areas of the field

       (Note: The head ditch or head pipeline extends along one end or one side of the field to be irrigated.)
    4. Turnouts -- Are used for releasing the water from the head ditch or pipeline onto the land to be irrigated

       (Note: On a head ditch, turnouts may be flood gates or siphon tubes. On a pipeline, turnouts may be gates such as on gated pipe or hydrant valves.)

5. Tail water ditch — Used for collecting excess water for reuse

   (Note: The tail water ditch is located at the end or side of the field opposite to the head ditch. This arrangement is important for several reasons. It allows a higher flow rate through the irrigated strip which increases the uniformity of water application. It saves the excess water and makes it available for reuse by pumping it back to the head ditch or pipe, or into another area to be irrigated.)

C. Types of surface irrigation systems

   (Note: Surface systems are designed to fit two conditions: (1) level land - that with less than .1 percent slope, and (2) sloping land - that with .1 percent slope to as much as 15 percent. The type of surface system you consider will be determined by the amount of slope you have in the area you plan to irrigate.)

   1. Level systems (Transparency #13)

      a. Border

      b. Contour levee

      c. Furrow

   2. Graded systems (Transparency #14)

      a. Border

      b. Contour ditch

      c. Furrow

      d. Corrugation

      e. Contour furrow

XII. Sprinkler irrigation

   A. Water is sprayed through the air and it falls to the ground like rain; this is accomplished by using either one or more rotating sprinklers or spray nozzles

   B. Basic units of a sprinkler system (Transparency #15)

      1. Pumping unit — Takes water from its source and makes it available under pressure to the system

         (Note: Pumping units are driven either by an electric motor or an internal combustion engine.)

INFORMATION SHEET

2. Mainline pipe -- Delivers the water from the pumping unit to the laterals

   (Note: Mainline pipe may be either permanent or portable. Pipe installed above ground is usually steel or aluminum. Pipe installed below ground is usually plastic, asbestos cement, or steel.)

3. Lateral pipe -- Delivers the water from the mainline pipe to the sprinklers

   (Note: Lateral pipe is of the same type and materials as mainline pipe but usually a smaller size.)

4. Sprinklers -- Located at intervals along the lateral, the sprinklers break up the water into various size drops and distribute over the ground

   a. Types of sprinklers (Transparency #16)

      1) Rotary sprinklers

      2) Spray-type nozzle

C. Types of sprinkler irrigation systems (Transparency #17)

   1. Solid set (permanent)

   2. Hand lines (portable)

   3. Lateral move (self-propelled)

   4. Center pivot (self-propelled)

   5. Big guns (portable or self-propelled)

XIII. Factors that affect the selection of different types of irrigation systems (Transparencies #18 and #19)

   A. Land slope

   B. Water intake rate of soil

   C. Water tolerance of crops

   D. Wind action

   E. Shape of field

   F. Maximum height of crop

   G. Labor required

   H. Cost

Soil Texture and Water Intake Rates

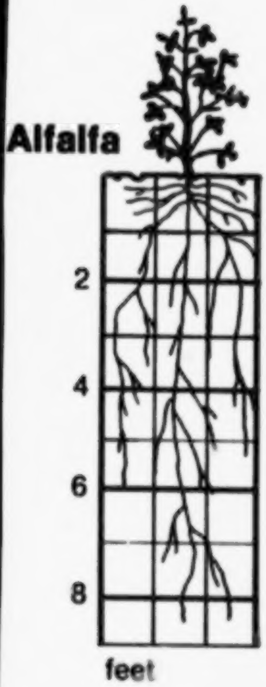
Texture Class	**Basic Intake Rate**
Coarse sand	0.75 - 1.00"/hr
Fine sands	0.50 - 0.75"/hr
Fine sandy loams	0.35 - 0.50"/hr
Silt loams	0.25 - 0.40"/hr
Clay loams	0.10 - 0.30"/hr

Average water holding capacity of soils representing different textural classes.

Soil Texture Class	WHC (in/ft)
Sand	0.43
Loamy Sand	0.84
Sandy loam	1.67
Sandy clay loam	1.12
Loam	2.10
Silt loam	2.44
Silt	2.12
Clay loam	1.08
Silty clay loam	2.10
Silty clay	2.91
Clay	1.94

Effective Root Zones of Common Crops

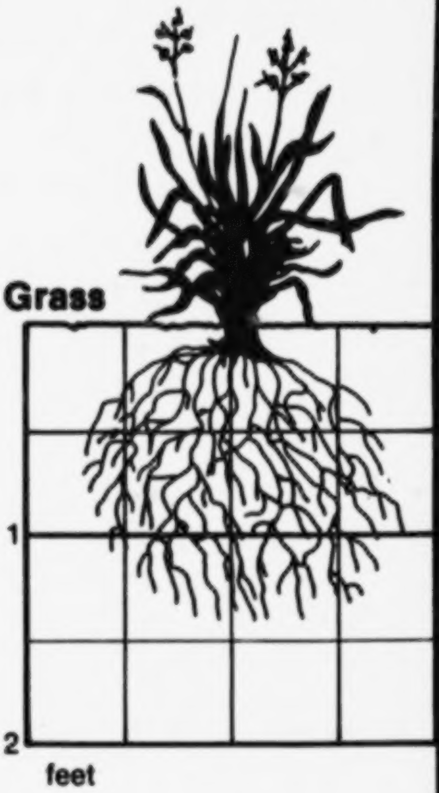
Taproot


Alfalfa
2
4
6
8
feet

Effective crop root zone depth (no soil barrier)

Crop	Depth (ft)
Alfalfa	4.0
Beans	2.0
Field corn	3.0
Sweet corn	2.5
Mint	2.0
Onions	1.5
Potatoes	2.0
Small grains	3.5
Sugar beets	3.0
Peas	2.0
Pasture	2.0

Fibrous Root


Grass
1
2
feet

Soil Moisture Scheduling Procedure

1. Determine total available moisture of crop root zone.
2. Determine present soil moisture available for crop use.
3. Determine crop stress point, and calculate percent moisture remaining for plant use.
4. Estimate crop water use from E_t table.
5. Calculate days remaining until next irrigation by dividing the number of inches of water remaining by the E_t value.

Crop Stress Point* or Percent Moisture Remaining at Irrigation

Crop	First irrigation	Later irrigation	
Potatoes	65	50	(at vine kill)
Sugar beets	50	50	
Sweet corn	40	60	
Field corn	40	50	
Mint	60	60	
Beans	60	60	
Small grains	40	60	(from boot stage through flowering)
Onions	60	70	
Alfalfa hay	50	50	
Pasture	50	50	

*Check soil moisture for crop stress point approximately one-third the depth of crop root zone (potatoes, 8 to 10 inches deep).

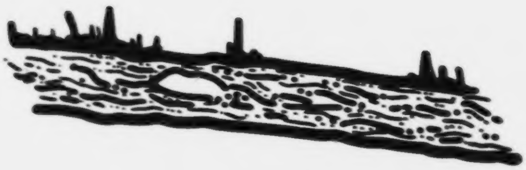
Units of Water Measurement

Volume

Pond or Reservoir

1. Gallons
2. Acre-inches
3. Acre-feet

Flow Rate



Stream or Ditch

1. Gallons per minute
2. Cubic feet per second
3. Miners inches

Conversion of Units of Water Measurement

1 gallon = 231 cubic inches
= 8.33 lbs

1 cubic foot = 7.48 gallons
= 62.4 lbs.

1 acre-foot = 43,560 cubic feet
= 325,850 gallons
= 12 acre-inches

1 acre-inch = 27,154 gallons
= 8,630 cubic feet

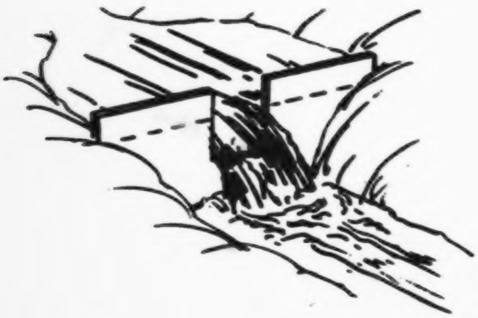
1 gallon per minute = 0.00223 cubic feet per second

1 cubic foot per second = 7.48 gallons per second
= 450 gallons per minute
= 646.272 gallons per day
= 1.983 acre foot per day
= 50 miners inches in Idaho

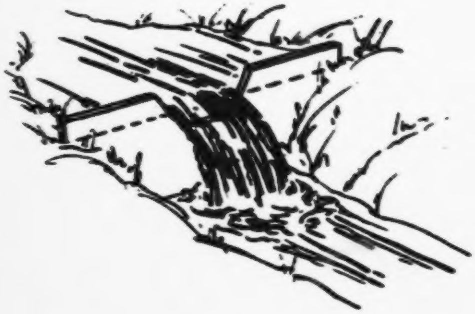
Equivalent Rate of Flow

Cubic feet per second (cfs)	Gallons per minute (gpm)	Acre-inches per hour	Acre feet per day (24 hours)	Idaho miner's inches
0.2	90	0.2	0.4	10
0.4	180	0.4	0.8	20
0.6	270	0.6	1.2	30
0.8	360	0.8	1.6	40
1.0	450	1.0	2.0	50
1.2	540	1.2	2.4	60
1.4	630	1.4	2.8	70
1.6	720	1.6	3.2	80
1.8	810	1.8	3.6	90
2.0	900	2.0	4.0	100
2.2	990	2.2	4.4	110
2.4	1080	2.4	4.8	120
2.6	1170	2.6	5.2	130
2.8	1260	2.8	5.6	140
3.0	1350	3.0	6.0	150
3.2	1440	3.2	6.4	160
3.4	1530	3.4	6.8	170
3.6	1620	3.6	7.2	180
3.8	1710	3.8	7.6	190
4.0	1800	4.0	8.0	200
5.0	2250	5.0	10.0	250
6.0	2700	6.0	12.0	300
7.0	3150	7.0	14.0	350
8.0	3600	8.0	16.0	400
9.0	4050	9.0	18.0	450
10.0	4500	10.0	20.0	500

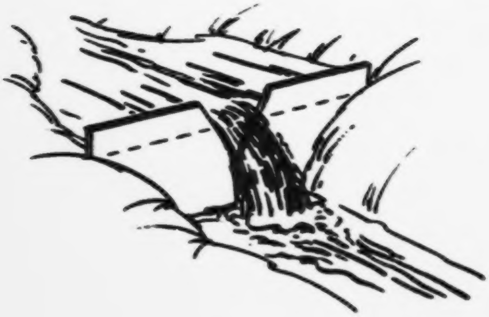
Types of Weirs



Rectangular weir

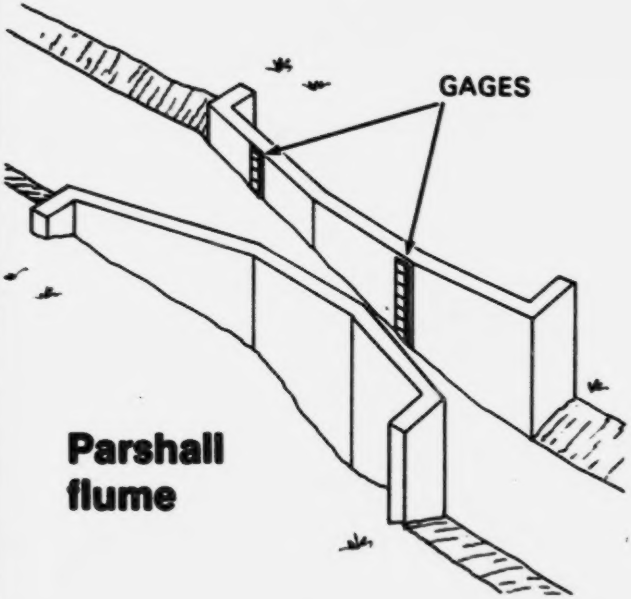


Cipolletti weir

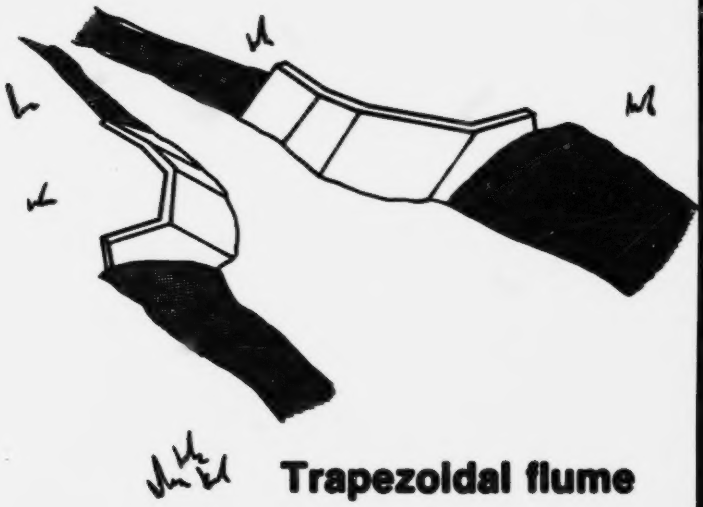


V-notch weir

Types of Flumes

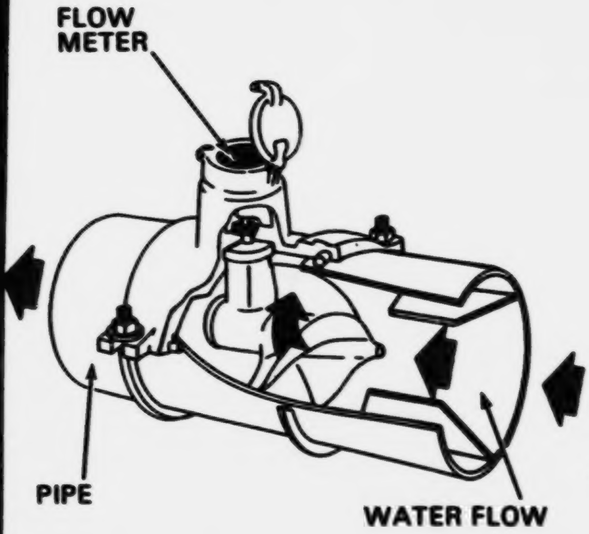


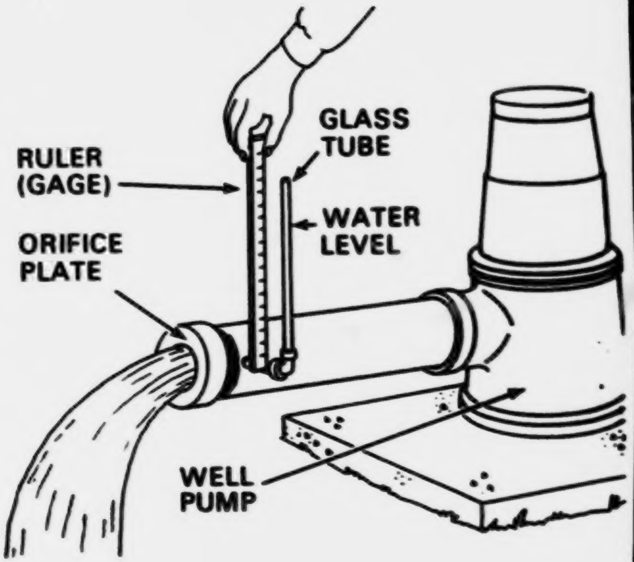
Parshall flume



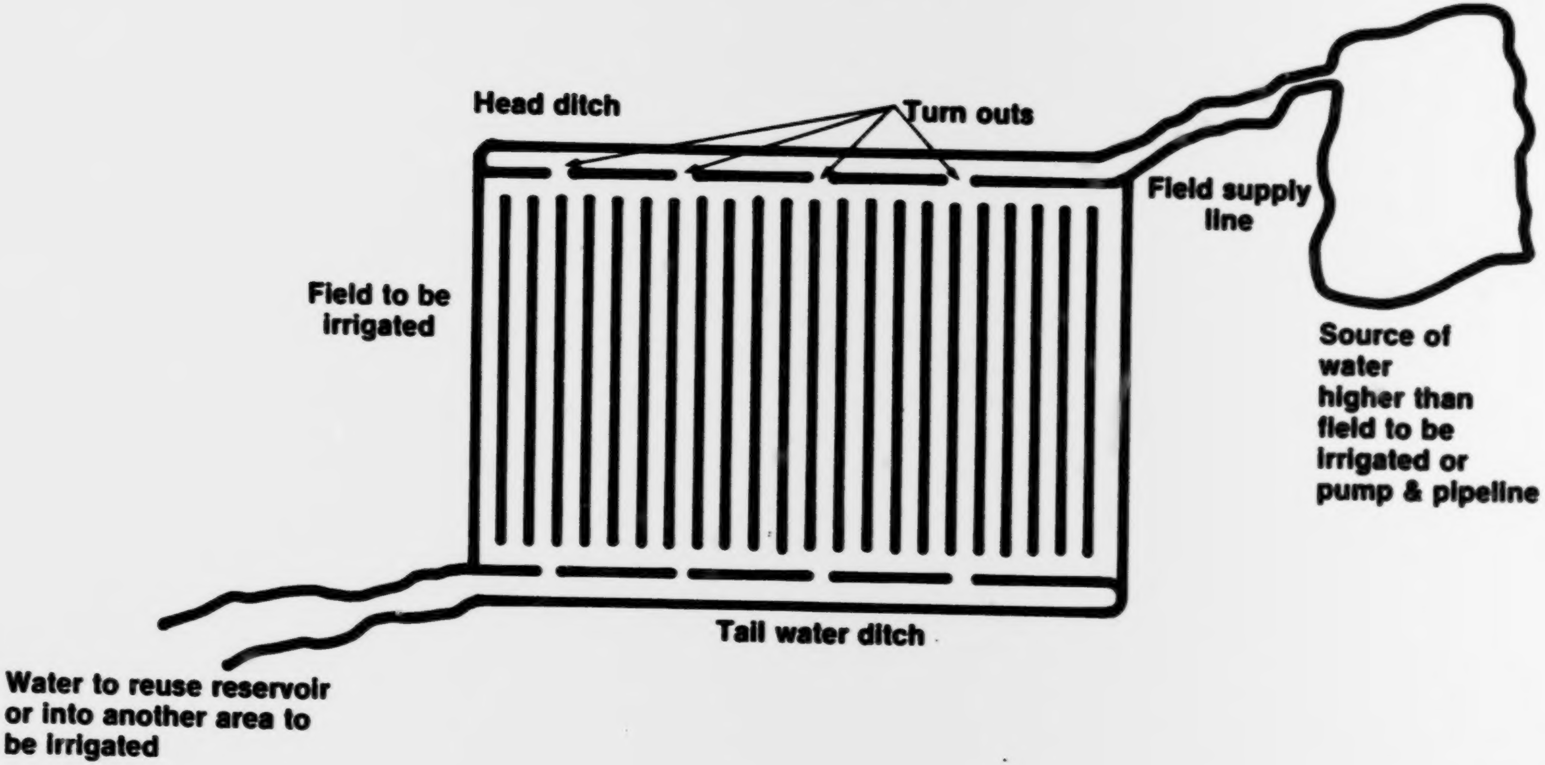
Trapezoidal flume

Types of Flowmeters


FLOW METER
PIPE
WATER FLOW


GLASS TUBE
RULER (GAGE)
WATER LEVEL
ORIFICE PLATE
WELL PUMP

Parts of a Surface Irrigation System


Head ditch
Turn outs
Field supply line
Field to be irrigated
Source of water higher than field to be irrigated or pump & pipeline
Tail water ditch
Water to reuse reservoir or into another area to be irrigated

TM #12

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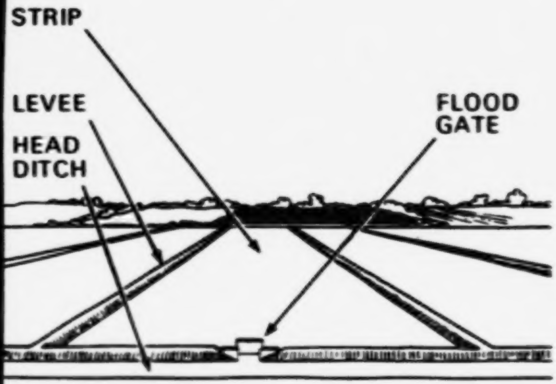
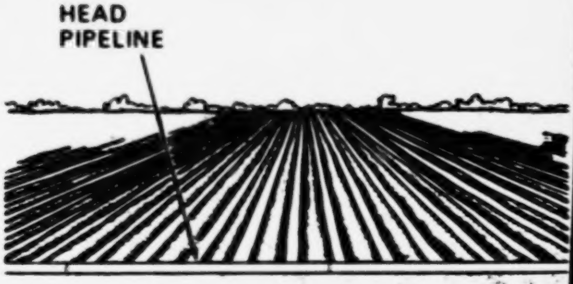
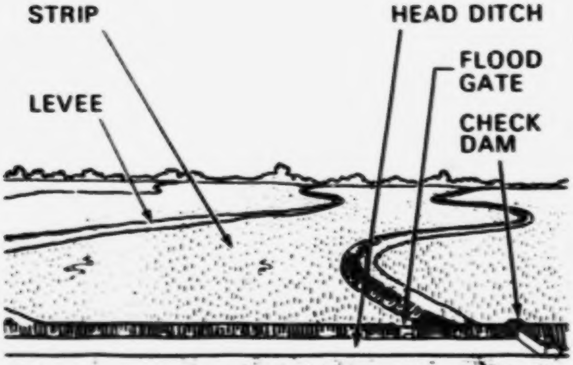
Level Systems of Surface Irrigation


STRIP
LEVEE
HEAD
DITCH
FLOOD
GATE

LEVEL BORDER

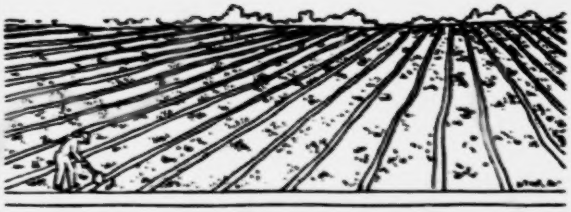

HEAD
PIPELINE

LEVEL FURROW

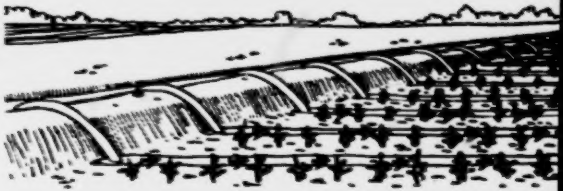

STRIP
LEVEE
HEAD DITCH
FLOOD
GATE
CHECK
DAM

CONTOUR LEVEE

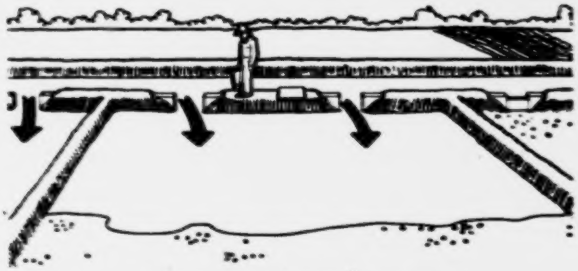
Graded Systems of Surface Irrigation



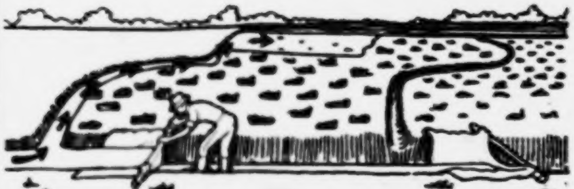
CORRUGATION



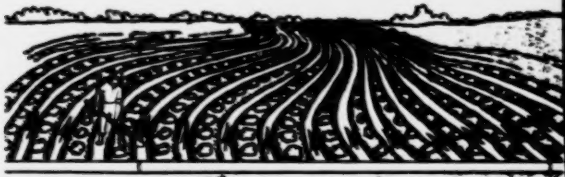
GRADED FURROW



GRADED BORDER

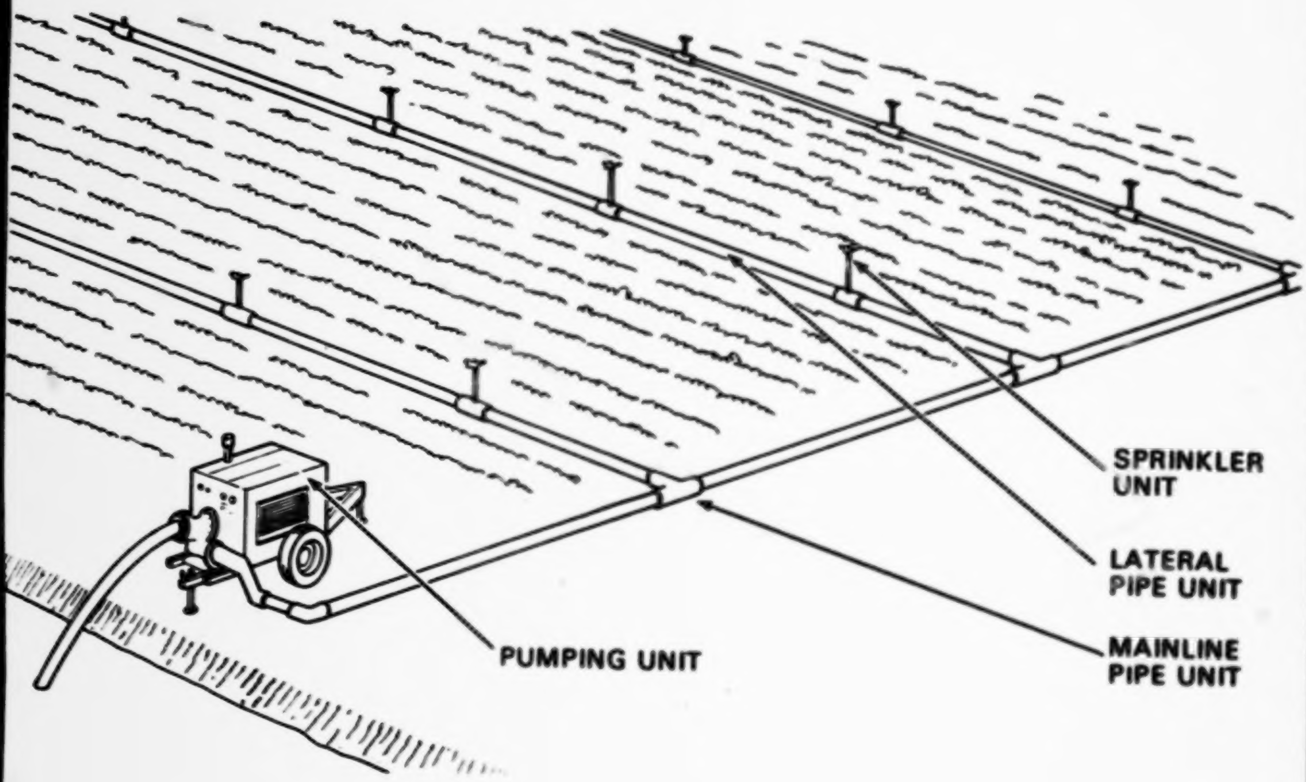


CONTOUR DITCH



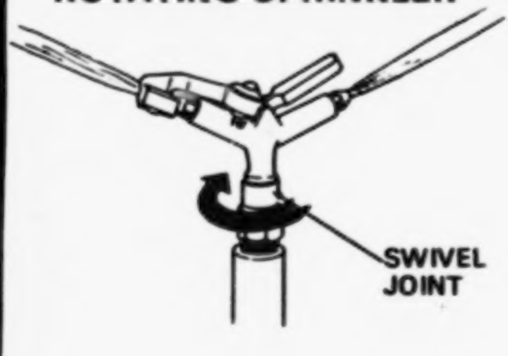
CONTOUR FURROW

Parts of a Sprinkler Irrigation System

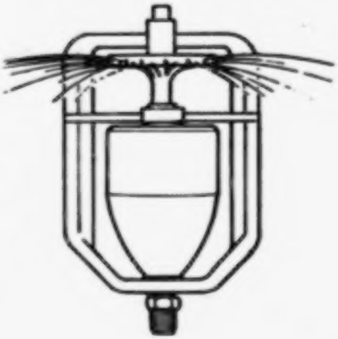

SPRINKLER UNIT
LATERAL PIPE UNIT
MAINLINE PIPE UNIT
PUMPING UNIT

Common Types of Sprinklers

ROTATING SPRINKLER

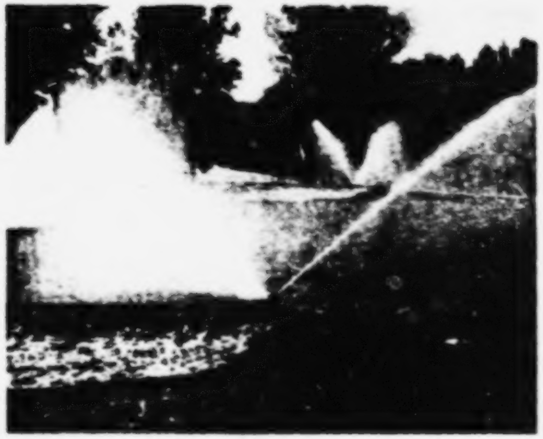

SWIVEL
JOINT

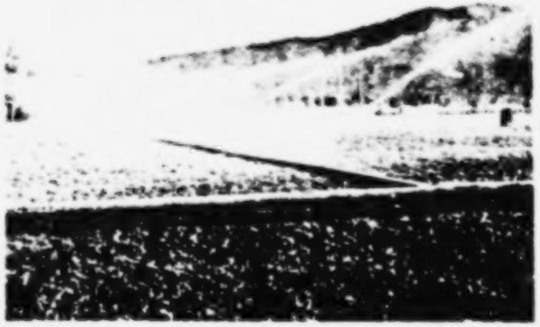
SPRAY NOZZLE



Types of Sprinkler Irrigation Systems

Solid set (permanent)

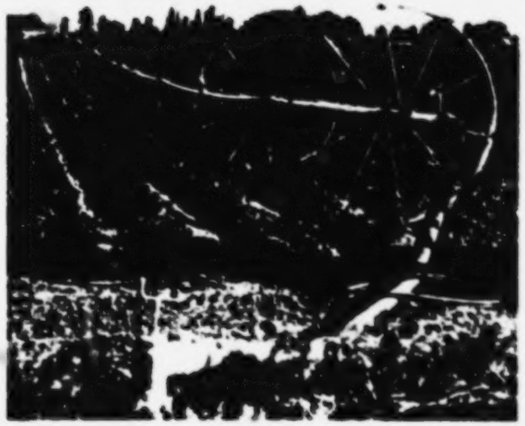


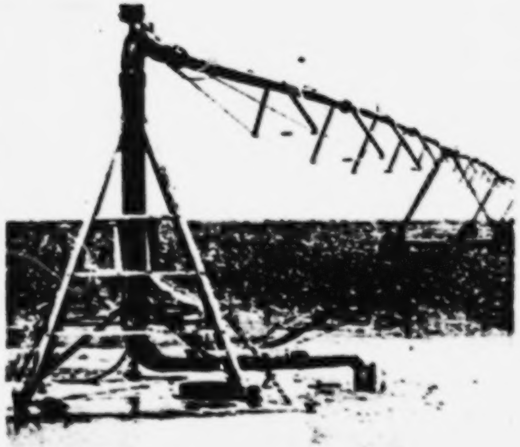


Hand lines (portable)

Big gun (portable)

Lateral move





Center pivot

TM #17

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Factors That Affect the Selection of Irrigation Systems

A. Land slope
B. Water intake rate of soil
C. Water tolerance of crops
D. Wind action
E. Shape of field
F. Maximum height of crop
G. Labor required
H. Cost

Comparison of Investment Costs for Irrigation Systems

	Center pivot 1	Center pivot with end gun 1	Wheel line sprinkler system 2	Handline sprinkler system 2	Solid set sprinkler system 2	Gated pipe gravity system 3	Siphon tuber gravity system 3
System investment per acre	$385.58	$420.14	$338.18	$361.48	$1,028.32	$297.98	$114.24
Variable costs per irrigated acre	35.01	36.80	36.65	52.62	56.69	13.90	17.88
Fixed costs per irrigated acre	61.16	66.78	52.99	54.97	164.22	45.02	17.45
Total fixed and variable costs per irrigated acre	96.17	103.58	89.64	107.59	220.91	58.92	35.33

1 CIS Bulletin #579
2 CIS Bulletin #578
3 CIS Bulletin #577

IRRIGATION
UNIT 3

ASSIGNMENT SHEET #1--CALCULATE TOTAL AVAILABLE MOISTURE

Name____Score_______________

Using the information given, calculate the total available moisture (TAM) of the soil and how much water will be applied at each irrigation. Assume that irrigation will take place when 50% of the water has been depleted from the root zone. When completed return to instructor for evaluation.

A. Corn is growing in a silt loam soil (TAM of 2.55"/ft.) with an average root zone of 7 feet.

TAM_________________________

Amount to apply_____________

B. Wheat is growing in a sandy loam soil (TAM of 1.67"/ft.) with an average root zone of 2 feet.

TAM_________________________

Amount to apply_____________

C. Alfalfa is growing in a silty clay soil (TAM of 2.91"/ft.) with average root zone of 6 feet.

TAM_________________________

Amount to apply_____________

IRRIGATION
UNIT 3

ASSIGNMENT SHEET #2--CALCULATE DAYS TILL NEXT IRRIGATION

Name____Score________________

Using the information given, calculate the number of days until next irrigation. Round numbers to the lesser whole number. When complete return to intructor for evaluation.

A. Barley

Soil type--silt loam
Root zone depth--3.5 feet
Average soil moisture--80%
Crop stress point--40%
E_t--.05

B. Potatoes

Soil type--sand
Root zone depth--2.0 feet
Average soil moisture--90%
Crop stress point--65%
E_t--.27

C. Corn

Soil type--sandy loam
Root zone depth--3.0 feet
Average soil moisture--75%
Crop stress point--50%
E_t--.30

D. Sugar beets

Soil type--loam
Root zone depth--3.0 feet
Average soil moisture--70%
Crop stress point--50%
E_t--.27

IRRIGATION
UNIT 3

ASSIGNMENT SHEET #3--CALCULATE IRRIGATION LENGTH

Name____________________________________Score____________

Using information, calculate the length of each irrigation in hours. When completed, return to instructor for evaluation.

A. A medium texture soil has a water intake rate of .25 inches per hour. How many hours will it take to apply 3 inches of water?

B. A light texture soil has a water intake rate of .50 inches per hour. How many hours will it take to apply 3 inches of water?

C. A heavy texture soil has a water intake rate of .10 inches per hour. How many hours will it take to apply 3 inches of water?

IRRIGATION
UNIT 3

ASSIGNMENT SHEET #4--CONVERT UNITS OF WATER MEASUREMENT

Name______________________________ Score__________

Using the conversion of units of flow from the information section, answer the following questions. When completed, return to instructor for evaluation.

A. A quarter-mile sprinkler line has 32 nozzles which deliver 5 gpm. What is your flow in cubic feet per second?

______cubic feet/second

B. A flow of 2 c.f.s. equals how many gallons per minute?

______gallons per minute

C. 1 c.f.s. flowing for 24 hours equals how many acre-inches and acre feet?

______acre inches

______acre feet

D. 130 sprinkler nozzles are delivering 6.5 gpm. How many miner's inches are needed by the system?

______miner's inches

E. With a flow of 2 c.f.s., how many acre-inches will be delivered in 48 hours?

______acre-inches

IRRIGATION
UNIT 3

ANSWERS TO ASSIGNMENT SHEETS

1. A. TAM = 17.85"
   Amount to apply = 8.9

   B. TAM = 3.34"
   Amount to apply = 1.7

   C. TAM = 17.46"
   Amount to apply - 8.7"

2. A. 61 days
   B. 2 days
   C. 3 days
   D. 4 days

3. A. 12 hours
   B. 6 hours
   C. 30 hours

4. A. .36 cfs
   B. 900 gpm
   C. 1.983 acre feet, 23.8 acre inches
   D. 94 miner's inches
   E. 47.6 acre inches

IRRIGATION
UNIT 3

TEST

Name____Score________________

1. Match terms associated with irrigation to the correct definitions. Write the correct numbers in the blanks.

    1. Irrigation
    2. Soil texture
    3. Soil structure
    4. Slope
    5. Water table
    6. Soil profile
    7. Root zone
    8. Irrigation frequency
    9. Weir
    10. Measuring flume
    11. Flowmeter
    12. Corrugate
    13. Ditch

_____a. That part of the soil profile from which growing plants can utilize water and nutrients

_____b. A measurement of difference in elevation from one point to another; it is generally referred to as percent--the number of feet difference in elevation for 100 feet of horizontal distance

_____c. A device used for measuring water flow from a well or pipeline

_____d. The combination or arrangement of soil particles (sand, silt, clay) into aggregates

_____e. A vertical cross-section of the soil from the surface through all its horizons

_____f. Chute placed in a stream or channel to measure the flow of water

_____g. A series of parallel furrows commonly used in surface irrigation systems to direct the flow of water between seedbeds

_____h. To supply land with water by means of ditches, sprinklers, or other system

_____i. The number of days between irrigations

_____j. Channel for carrying water; for drainage or irrigation of the soil

_____k. A name given a textural group based on the relative proportions of the soil separates (sand, silt, clay)

TEST

_____l. The level at which the soil is saturated with water; usually below the soil surface

_____m. An obstruction placed in a stream or channel diverting the water through a device to measure the flow of water; types include rectangular, cipolleti, and v-notch

2. List three reasons for irrigating.

a. ____________________

b. ____________________

c. ____________________

3. Select from the following list factors that affect water intake rates of soils. Write an "X" in the blank before each correct answer.

_____a. Surface texture

_____b. Subsurface texture

_____c. Depth of soil profile

_____d. Slope

_____e. Soil structure

_____f. Root zone

4. Calculate the total available moisture for barley, which has an effective root zone of 2.5 feet, grown on a sandy loam soil which has a water holding capacity of 1.67 inches/foot. Show all work.

TEST

5. Name three methods for estimating soil moisture in the crop root zone.

   a. ______________________________

   b. ______________________________

   c. ______________________________

6. Calculate the days remaining until the next irrigation for alfalfa using the following information. Show all work.

   A. Effective root zone--4.0 feet

   B. Silt loam soil--Water holding capacity of 2.2 inches/foot

   C. Soil moisture monitored on July 10

      1) 1st foot--50% available moisture

      2) 2nd foot--60% available moisture

      3) 3rd foot--80% available moisture

      4) 4th foot--90% available moisture

      (Note: The root zone average is 70% available moisture.)

   D. Stress point for alfalfa--50%

   E. E_t rate = .27 inches/day

   F. Days till next irrigation______________________________

7. Name two units of volume measurement and two units of flow rate measurement of water.

   a. Volume measure

      1) ______________________________

      2) ______________________________

   b. Flow rate measure

      1) ______________________________

      2) ______________________________

TEST

8. Convert 5 cubic feet per second of water flow into:

   A. Gallons per minute____________________

   B. Acre-inches per hour__________________

   C. Acre-feet per day_____________________

   D. Miner's inches_______________________

9. Name three devices for measuring water in motion.

   a. ____

   b. ____

   c. ____

10. List four types of irrigation systems.

   a. ____

   b. ____

   c. ____

   d. ____

TEST

11. Match the basic parts of a surface irrigation system to the correct description. Write the correct numbers in the blanks.

    1. Water supply
    2. Field supply line
    3. Head ditch or head pipeline
    4. Turnouts
    5. Tailwater ditch

_____a. Are used for releasing the water from the head ditch or pipeline onto the land to be irrigated

_____b. It is the means by which water is delivered from the source to the field; it may be an open ditch or a pipeline

_____c. Used for collecting excess water for reuse

_____d. It is the means by which water is made available from the field supply line to the different areas of the field

_____e. Common sources include: farm ponds, rivers, canals and wells

12. Match the basic parts of a sprinkler irrigation system to the correct description. Write the correct numbers in the blanks.

    1. Pumping unit
    2. Mainline pipe
    3. Lateral pipe
    4. Sprinklers

_____a. Delivers the water from the mainline pipe to the sprinklers

_____b. Located at intervals along the lateral; break up water into various size drops and distribute over the ground

_____c. Takes water from its source and makes it available under pressure to the system

_____d. Delivers the water from the pumping unit to the laterals

TEST

13. Select from the following list factors that affect the selection of an irrigation system. Write an "X" in the blank before each correct answer

_____a. Soil texture

_____b. Cost

_____c. Average wind speed

_____d. Labor required

_____e. Slope of field

_____f. Shape of field

_____g. Water tolerance of crop

_____h. Maximum height of crop

IRRIGATION
UNIT 3

ANSWERS TO UNIT TEST

1. a. 7
   b. 4
   c. 11
   d. 3
   e. 6
   f. 10
   g. 12
   h. 1
   i. 8
   j. 13
   k. 2
   l. 5
   m. 9

2. a. Provide water for crops in the right amount at the right time.
   b. Increase crop yield
   c. Improve crop quality

3. a, d, e

4. 4.2"

5. a. Plant and field methods
   b. Feel method
   c. Tensiometers

6. 6.52 or 6 days till next irrigation

7. a. any of the following: gallons, acres, inches acre-feet
   b. any of the following: gallons per minute, cubic feet per second, miner's inches

8. a. 2250 gpm
   b. 4.95 acre-inches per hour
   c. 9.92 acre-feet
   d. 250 miner's inches

9. a. weir
   b. flume
   c. flowmeter

10. a. Surface
    b. Sprinkler
    c. Trickle
    d. Subsurface

11. a. 4, b. 2, c. 5, d. 3, e.1

12. a. 3, b. 4, c. 1, d. 2

13. a, b, c, d, e, f, g, h

LAND PREPARATION
UNIT 4

UNIT OBJECTIVE

After completing this unit, the student should be able to match terms and definitions and select from a list reasons for tillage. The student should be able to identify equipment used in land preparation, determine when to plow, and discuss the advantages of turning under crop residue. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the students should be able to:

1. Match terms associated with land preparation to the correct definitions.
2. Select from a list reasons for tillage.
3. Name four characteristics of a good seedbed.
4. Classify tillage operations as primary or secondary.
5. Select from a list factors that determine time for primary tillage operation.
6. List two advantages of fall plowing and two advantages of spring plowing.
7. Select from a list advantages of incorporating residue.
8. List two reasons for stubble mulching.
9. List two purposes of summer fallowing.
10. Select from a list reasons to use minimum tillage.

LAND PREPARATION
UNIT 4

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit.

      1. Literature

         a. Tillage, an FMO publication by John Deere and Co. 19 chapters on tillage and tillage equipment. Order from John Deere Service Publications, Dept. F., John Deere Road, Moline, Illinois, 62165.

         b. Tillage and Seedbed Preparation, class activity packet available from Agri-Farm Publications, Inc., 1019 Market Street, Gowrie, Iowa, 50543; approximate cost $8.50; order no. 1117.

      2. Filmstrips, slideshows, etc.

         a. Tillage, slide set available from: John Deere Service Publications, Dept. F., John Deere Road, Moline, Illinois, 62165; approximate cost $124.00.

         b. Tillage Machines, 39 color slides, available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $17.00, order no. 311.

      3. Films

   B. Make transparencies

   C. Provide student with objective sheet

   D. Provide student with information sheet

   E. Discuss unit and specific objectives

   F. Discuss information sheet

   G. Take class on field trip to an implement dealer to see types of tillage equipment used in the community

SUGGESTED ACTIVITIES

H. Have students collect pictures of tillage implements and bring to class

I. Assign each student a report on a single piece of tillage equipment to be presented to the class

J. Give test

K. Reteach if necessary

L. Retest

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Test

E. Answers to test

III. Unit references

A. Instructional Materials for Vocational Agriculture. College Station Texas, Teaching Materials Center, Agricultural Education Department, Texas A & M University.

B. Delorit, Greub, and Ahlgren, Crop Production, 4th Edition, Englewood Cliffs, NJ, Prentice Hall, Inc. 1974.

C. Oklahoma Curriculum Guide for Vo Ag II, Stillwater, OK, Oklahoma State University and the Oklahoma State Board for Vocational-Technical Education.

D. Crops, Soils, and Fertilizer Resource Manual, Vo Ed No. 73, Moscow, ID, University of Idaho, Dept. of Agricultural Education, 1978.

E. Fundamentals of Machine Operation: Tillage, Moline, Illinois, John Deere Service Publications, 1976.

LAND PREPARATION
UNIT 4

INFORMATION SHEET

I. Terms and definitions

   A. Tillage--Cultivation used to prepare or maintain a seedbed and/or control weeds

   B. Cultivate--To break up the surface soil around plants in order to kill weeds, prevent crusting, preserve moisture and form corrugates for irrigation

   C. Crop residue--Part of the crop that is left on top or in the soil after harvesting

   D. Stubble mulching--Tillage beneath the stubble without covering all the crop residue; operated just below soil surface; used to kill weeds and encourage water infiltration and storage

   E. Erosion--Removal of soil by wind and/or water

   F. Land preparation--Complete process of preparing the soil after a crop is harvested until a new crop is planted

   G. Summer fallow--Cropland left idle for one growing season, while the soil is being cultivated to control weeds, release nitrogen, and conserve moisture

   H. Minimum tillage--Is a method of tillage in which certain operations are combined or eliminated to reduce the number of trips across a field

   I. Moldboard plow--Primary tillage implement made up of a series of plow bottoms; it cuts, lifts and turns the furrow slice burying the crop residue

   J. Plow bottom--A three-sided wedge which inverts furrow slice; each bottom is attached to a standard, which in turn is attached to the plow frame

   K. Disk plow--Primary tillage implement made up of a series of disks; it cuts, lifts and rolls but does not invert the furrow slice

   L. Disk--Round, concave, rotating blades made in a variety of diameters; used for primary and secondary tillage operations

   M. Chisel plow--Primary tillage implement made up of a series of chisels; used to break up hard, dry soils for water penetration where coverage of crop residue is not required

INFORMATION SHEET

N. Chisel--A narrow, straight shank tool often with a point; each chisel is attached directly to the plow frame

O. Sweep--A "V"-shaped blade used on a chisel plow for stubble mulching; each sweep is attached directly to the plow frame

P. Standard--Supports for soil working tools of primary tillage implements, such as bottoms on plows

Q. Plow pan--Compacted layer restricting root and water movement; may form in some soils just below the tilled area after several years of primary tillage to the same depth

II. Reasons for tillage

A. Eliminate weeds

(Note: It is important to control weeds as competitors against the cultivated crop for water, nutrients and sunlight. Chemicals are replacing tillage as a system of weed control.)

B. Improve soil condition for seed germination and plant growth

(Note: The preparation of the seedbed must be timed so that the crop seed can be planted when environmental factors favor germination of the seed and the establishment of the seedling as a new plant.)

C. Aerate the soil

D. Destroy insects

E. Prepare land surface for irrigation

F. Aid in erosion control

G. Conserve moisture

H. Incorporate crop residue

III. Characteristics of a good seedbed

(Note: Seedbed preparation is determined by the crop to be planted.)

A. Free of trash and weeds

B. Firm

(Note: The soil should be firm enough to prevent rapid drying and furnish a good medium for tiny root hairs. The seed must be in direct contact with the soil particles in order to receive adequate soil moisture.)

INFORMATION SHEET

C. Loose and mellow

(Note: Loose soil will permit better air circulation and seedling growth. It is necessary that plant roots expand easily through the soil.)

D. Minimum of plant disease

(Note: Crop rotation, fall plowing and the use of fungicides help eliminate plant disease problems.)

E. Minimum of insects

(Note: Crop rotation, use of insecticides, shredding of stalks and weeds and fall plowing will help free the soil of insects.)

F. Absorb and hold water

(Note: Moisture is necessary for germination and plant development. Moisture dissolves the nutrients, making them available to the plant roots.)

IV. Classification of tillage operations

A. Primary tillage--Cuts, shatters, and/or mixes the soil; may bury residue by inversion, mix it into the tilled layer, or leave it basically undisturbed

(Note: Primary tillage is a more drastic, relatively deep operation, usually leaving the surface rough.)

1. Implements used for primary tillage

   a. Moldboard, disk, and chisel plows

   b. Bedders and listers

   c. Subsoilers, chisels and rippers

   d. Rotary tillers

B. Secondary tillage--Provides additional pulverization of soil; levels and firms the soil, closes air pockets, helps to conserve moisture and kills weeds

(Note: Secondary tillage works the soil to a shallower depth than primary usually leaving the surface smooth.)

INFORMATION SHEET

1. Implements used for secondary tillage

    a. Spring, spike and tine-tooth harrows

    b. Roller harrows and packers

    c. Rod weeders

    d. Field cultivators

    e. Disk tillers

V. Factors that determine time for primary tillage operation

A. Type of crop

(Note: Seedbed preparation is determined by the crop to be raised. In a minimum tillage operation, primary tillage may be eliminated, where in other cases it may be necessary every year.)

B. Weed problem

(Note: Weeds may tend to use the nitrates that may be lost to leaching in heavy rainfall areas; therefore, plowing may be delayed. Weed seeds should be allowed to germinate prior to tillage for weed control purposes.)

C. Erosion

(Note: Certain areas have heavy rainfall which cause a danger of water erosion. Late fall or winter tillage is considered unadvisable in such areas.)

D. Moisture

(Note: The amount of moisture in the soil can often delay primary tillage for seedbed preparation . If soils are too wet, the seedbed becomes seriously compacted if preparation is attempted. If a soil is too dry, it must be irrigated several days before preparation of the seedbed begins.)

INFORMATION SHEET

VI. Advantages of fall and spring plowing

A. Fall

1. Incorporate residue to increase time for crop residue decomposition

2. Spring workload is reduced; crops can be planted earlier

3. Helps hold moisture in low rainfall areas

4. Improves chance of forming a firm seedbed

5. Allows time for clods to crumble from freezing and thawing

B. Spring

1. Crop residue over winter aids in controlling wind erosion on sandy soil

2. Eliminates weeds which germinate in the spring

3. Standing residue catches snow

(Note: Fall plowing is usually preferred if the climate, soil, and type of crop permits the practice. Experiments with corn, oats, barley, and wheat in different parts of the United States show there is no production advantage between fall and spring plowing or seedbed preparation. Both systems of plowing produce about the same amount of grain per cropping season.)

VII. Advantages of incorporating crop residue

A. Increases organic matter in the soil

B. Returns plant nutrients to the soil

C. Increases microorganism activity, population and residue breakdown

D. Conserves moisture

(Note: The turning under of crop residue is classified as primary tillage. Residues left on or near the surface often reduce growth yields of the next crop. This has been attributed to toxic compounds leached from the residue or to microbial production of toxic compounds during decomposition. This condition is reduced if the crop residue is incorporated.)

INFORMATION SHEET

VIII. Reasons for stubble mulching

A. Reduction of wind and water erosion

(Note: Stubble-mulch plows cut off crop residue below surface leaving residue anchored to the surface, an advantage where limited quantities of residue are present and erosion is a problem.)

B. Increase water intake

VIII. Purposes of summer fallowing

A. Conserve moisture

B. Control weeds

(Note: This is the practice of allowing land to lie idle during a growing season to build up available moisture to produce a crop the following year. This is recommended in areas with less than 16" annual precipitation under dry land conditions.)

IX. Reasons to use minimum tillage

A. Reduces number of operations

B. Reduce costs for energy and labor

C. Conserve soil moisture

D. Reduce erosion

E. Lower equipment investment

F. Permits earlier planting

G. Reduce soil compaction

(Note: Conservation tillage, mulch tillage, till-plant and zero till planting are types of minimum tillage systems. Weed control can be a problem with these systems, and the greater dependency on chemical weed control may offset savings in equipment and operating costs. If reduced-tillage cost savings exceed the value of possible yield reductions, net profit may be increased by accepting slightly lower yields.)

LAND PREPARATION
UNIT 4

TEST

Name____Score_______________

1. Match terms associated with land preparation to the correct definitions. Write the correct numbers in the blanks.

    1. Tillage
    2. Cultivate
    3. Crop residue
    4. Stubble mulching
    5. Erosion
    6. Land preparation
    7. Summer fallow
    8. Minimum tillage
    9. Moldboard plow
    10. Plow bottom
    11. Disk plow
    12. Disk
    13. Chisel plow
    14. Chisel
    15. Sweep
    16. Standard
    17. Plow pan

_____a. Complete process of preparing the soil after a crop is harvested until a new crop is planted

_____b. Primary tillage implement made up of a series of plow bottoms; it cuts, lifts and turns the furrow slice burying the crop residue

_____c. Part of the crop that is left on top or in the soil after harvesting

_____d. Round, concave, rotating blades made in a variety of diameters; used for primary and secondary tillage operations

_____e. A "V"-shaped blade used on a chisel plow for stubble mulching

_____f. Compacted layer restricting root and water movement; may form in some soils just below the tilled area after several years of primary tillage to the same depth

_____g. Cultivation used to prepare or maintain a seedbed and/or control weeds

_____h. A three-sided wedge which inverts furrow slice; each is attached to a standard, which in turn is attached to the plow frame

_____i. To break up the surface soils around plants in order to kill weeds, prevent crusting, preserve moisture and form corrugates for irrigation

_____j. Primary tillage implement used to break up hard, dry soils for water penetration where coverage of crop residue is not required

TEST

_____k. Supports for soil working tools of primary tillage implements, such as bottoms on plows

_____l. Removal of soil by tillage, wind and/or water

_____m. Is a method of tillage in which certain operations are combined or eliminated to reduce the number of trips across the field

_____n. A narrow, straight shank tool often with a point

_____o. Primary tillage implement that cuts, lifts and rolls but does not invert the furrow slice

_____p. Cropland left idle for one growing season, while the soil is being cultivated to control weeds, release nitrogen and conserve moisture

_____q. Tillage beneath the stubble without covering all the crop residue

2. Select from the following list reasons for tillage. Write an "X" in the blank before each correct answer.

_____a. Eliminate weeds

_____b. Aerate the soil

_____c. Aid in erosion control

_____d. Prepare land for irrigation

_____e. Destroy insects

_____f. Conserve moisture

_____g. Incorporate crop residue

3. Name four characteristics of a good seedbed.

a. ____

b. ____

c. ____

d. ____

TEST

4. Classify the following tillage operations. Write "P" in the blank for primary tillage operation or "S" for secondary tillage operation.

_____a. Moldboard plow

_____b. Spring-tooth harrow

_____c. Roller harrow

_____d. Rotary tiller

_____e. Chisel plow

_____f. Rod weeder

_____g. Field cultivator

_____h. Disk plow

_____i. Spike-tooth harrow

_____j. Subsoiler

5. Select from the following list factors that determine the time for primary tillage operation. Write an "X" in the blank before each correct answer.

_____a. Type of crop

_____b. Time of day

_____c. Month

_____d. Weed problem

_____e. Erosion

_____f. Moisture

6. List two advantages of fall plowing and two advantages of spring plowing.

A. Fall plowing

1. ____

2. ____

B. Spring plowing

1. ____

2. ____

TEST

7. Select from the followng list advantages of incorporating residue. Write an "X" in the blank before each correct answer.

_____a. Conserves moisture

_____b. Reduces weed problems

_____c. Reduces erosion

_____d. Returns plant nutrients to the soil

_____e. Increases organic matter in the soil

_____f. Decreases microorganism levels in the soil

8. List two reasons for stubble mulching.

a. ____

b. ____

9. List two purposes of summer fallowing.

a. ____

b. ____

10. Select from the following list reasons to use minimum tillage. Write an "X" in the blank before each correct answer.

_____a. Reduce number of trips across a field

_____b. Reduce weed problems

_____c. Reduce erosion

_____d. Conserve soil moisture

_____e. Reduce plant disease problems

_____f. Reduce soil compaction

_____g. Reduce costs for energy and labor

_____h. Permits earlier planting

LAND PREPARATION
UNIT 4

ANSWERS TO UNIT TEST

1. a. 6
   b. 9
   c. 3
   d. 12
   e. 15
   f. 17
   g. 1
   h. 10
   i. 2
   j. 13
   k. 16
   l. 5
   m. 8
   n. 14
   o. 11
   p. 7
   q. 4

2. a, b, c, d, e, f, g

3. Any of the following: Free of trash and weeds, firm, loose and mellow, minimum of plant disease, minimum of insects, absorb and hold water.

4. a. P
   b. S
   c. S
   d. P
   e. P
   f. S
   g. S
   h. P
   i. S
   j. P

5. a, d, e, f

6. A. Any of the following: Incorporate residue to increase time for crop residue decomposition, spring work load is reduced, crops can be planted earlier, helps hold moisture in low rainfall areas, improves chance of forming firm seedbed, allows time for clods to crumble from freezing and thawing.
   B. Any of the following: Aids in controlling erosion on sandy soil, eliminates weeds which germinate in the spring, standing residue catches snow.

7. a, d, e

8. Reduction of wind and water erosion, increase water intake.

9. Conserve moisture, control weeds

10. a, c, d, f, g, h

SOIL CONSERVATION PRACTICES
UNIT 5

UNIT OBJECTIVE

After completing this unit, the student should be able to list types of erosion and management practices that aid in conservation. The student should also be able to select from a list factors that determine cropping systems and conservation practices for reducing erosion. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with soil conservation practices to the correct definitions.
2. Name two types of erosion.
3. Match the four categories of water erosion to the correct description.
4. Select from a list factors that influence soil erosion.
5. Select from a list conservation practices for reducing wind erosion.
6. Select from a list mechanical and cropping practices used in water erosion conservation.
7. Select from a list factors that determine the type of cropping system to use.
8. Name two organizations involved with soil conservation.

SOIL CONSERVATION PRACTICES
UNIT 5

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. Conserving Soil: Teaching Soil and Water Conservation, available through Soil Conservation Service, United States Dept. of Agriculture.

      b. Several CIS publications on soil conservation available through the Cooperative Extension Service, University of Idaho, College of Agriculture.

      c. Soil and Water Conservation, 250-page loose-leaf packet, available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $12.50, order no. 229.

    2. Filmstrips, slideshows, etc.

      a. Conservation Farming, slide set available from John Deere Service Publications, Dept. F, John Deere Rd., Moline, IL, 61265; approximate cost $109.00.

      b. Conservation Tillage, 2 cassettes, 2 filmstrips and program guide; available from: Teaching Aids, Inc., P. O. Box 1798, Costa Mesa, CA, 92626; approximate cost $70.00, order no. P1319.

      c. Universal Soil Loss Equation, filmstrip with script, available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $15.00, order no. 336.

    3. Films

SUGGESTED ACTIVITIES

E. Assignment sheets

    1. AS 1--How do you rate as an FFA conservationist?

    2. AS 2--Conserving soil crossword puzzle

    3. AS 3--Locating good and poor conservation practices

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Crops, Soils, and Fertilizer Resource Manual, Vo-Ed No. 73, Moscow, ID, University of Idaho, Dept. of Ag Education, 1978.

B. Instructional Materials for Vocational Agriculture, College Station, Texas, Texas A & M University, Agriculture Education Dept., Teaching Materials Center.

C. Oklahoma Curriculum Guide for Vocational Agriculture, Stillwater, OK, Oklahoma State University and the Oklahoma State Board for Vocational-Technical Education.

D. Knuti, Williams, and Hide, Profitable Soil Management, Englewood Cliffs, NJ, Prentice-Hall, Inc. 3rd Edition, 1979.

E. Conserving Soil, United States Dept. of Agriculture, Soil Conservation Service.

SOIL CONSERVATION PRACTICES
UNIT 5

INFORMATION SHEET

I. Terms and definitions

A. Erosion--Removal of soil by tillage, wind and/or water

B. Water outlet--Ditch which carries the excess water from farm

C. Terracing--Structure designed to slow down running water and control erosion on sloping land

D. Crop rotation--Rotation of crops on a field from one crop to another

E. Strip-cropping--Practice of growing soil-conserving and soil-depleting crops in alternate strips running perpendicular to the slope of the land or the direction of prevailing winds for the purpose of reducing erosion

F. Diversion ditch--Ditch which prevents erosion by diverting water around a field rather than across

G. Cover crop--Crop used to cover the soil surface to decrease erosion

II. Types of Erosion (Transparencies #1, #2 and #3)

A. Water erosion

B. Wind erosion

C. Tillage erosion

III. Categories of water erosion (Transparency #4)

A. Splash--Caused by the effect of falling raindrops

(Note: A single raindrop may splash soil as far as 5 feet. A single beating one-inch rain may splash as much as one inch of soil depth by raindrop erosion. The weight of an acre of soil one inch deep is approximately 170 tons.)

B. Sheet--The removal of soil in a uniform layer from an entire surface area.

(Note: This type of erosion occurs continuously over periods of time, and the landowner may hardly be aware of its existence.)

INFORMATION SHEET

V. Wind erosion conservation practices (Transparency #6)

   A. Strip-cropping

   B. Prevention of burning

   C. Prevention of overgrazing

   D. Moisture conservation

   E. Emergency cover crops

   F. Emergency tillage operations

   G. Windbreak tree planting

   H. Shelter belt of trees

VI. Water erosion conservation practices (Transparency #7)

   A. Mechanical

   (Note: Mechanical measures are designed to supplement the cropping program as well as control the movement of large quantities of rainfall on steeper slopes.)

      1. Terracing

      2. Diversions

      3. Grass waterways

      4. Land drainage

      5. Land preparation

      6. Construction of ponds and dams

   B. Cropping

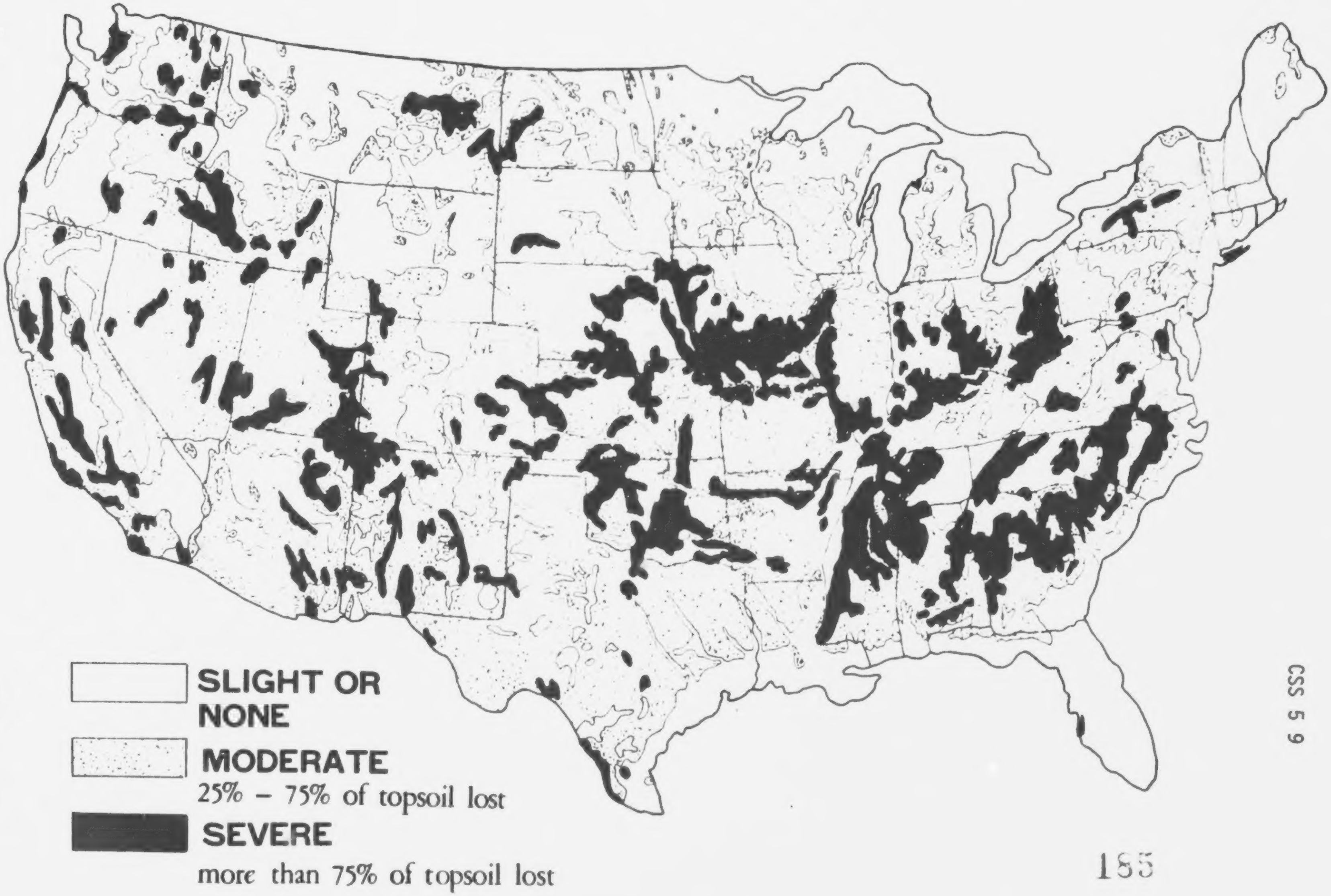
   (Note: Cropping practices recommended are an attempt to give as much protection to the ground surface as possible, while lands are being used, and also to increase the absorption of rainfall.)

      1. Subsoiling or chiseling

      2. Contour furrowing

      3. Contour listing

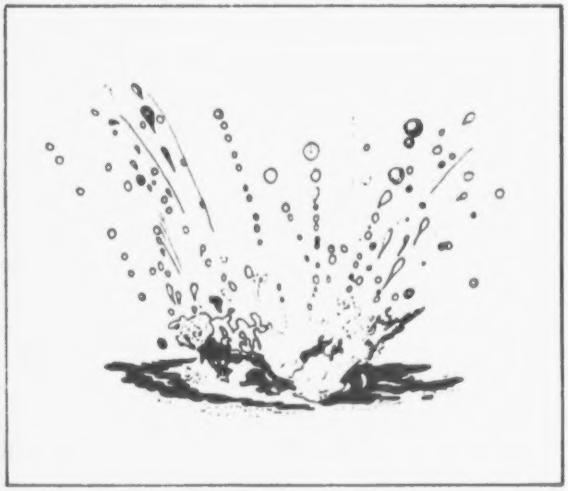
GENERALIZED SOIL EROSION MAP OF THE UNITED STATES


□ SLIGHT OR NONE
▨ MODERATE 25% – 75% of topsoil lost
■ SEVERE more than 75% of topsoil lost

TM #1

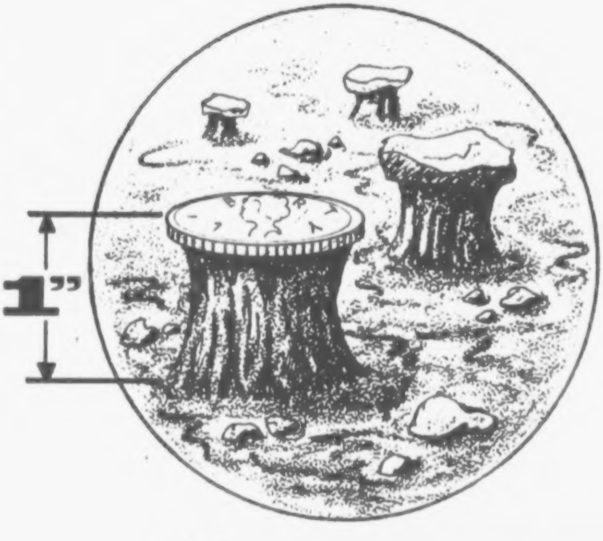
CSS 5 9

SOIL DETACHMENT BY RAINDROPS

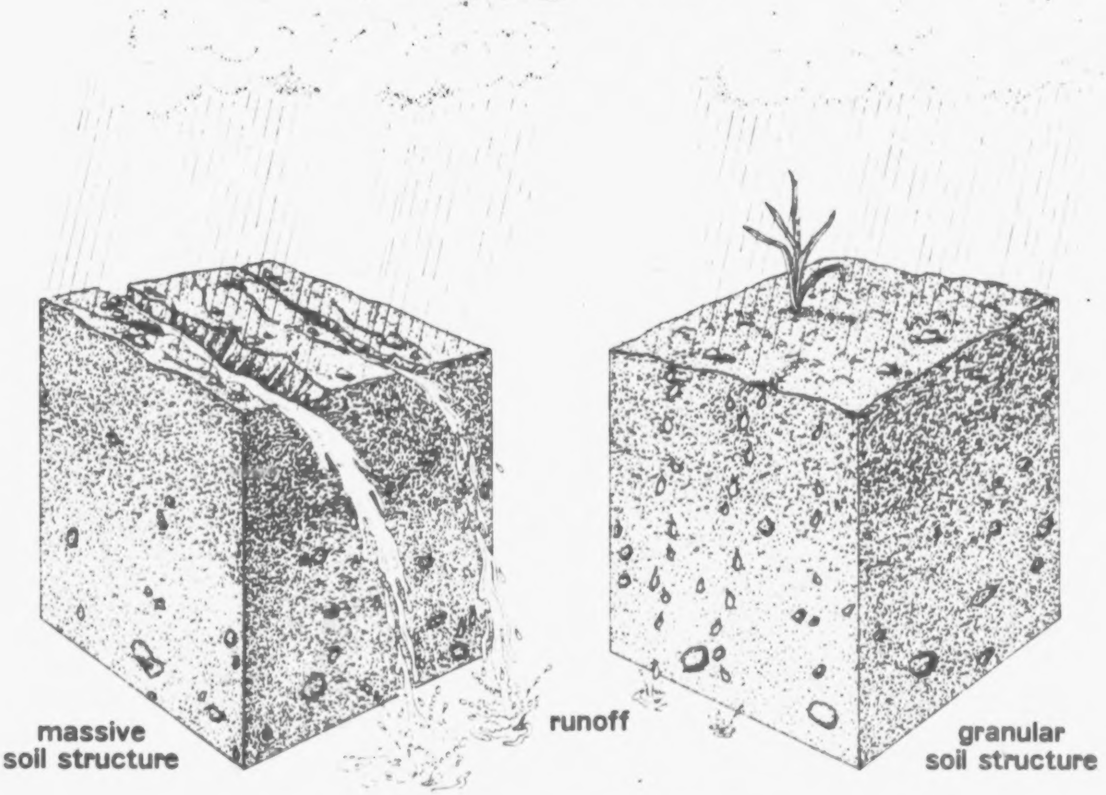


a raindrop may splash soil as far as 5 feet

a 1 inch rain may remove 1 inch of soil per acre (150 tons)



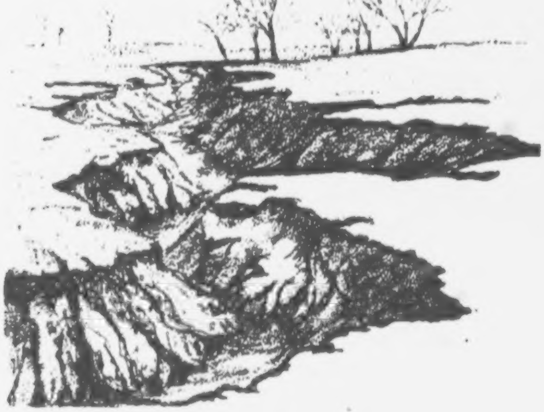
Water Erosion


massive
soil structure
runoff
granular
soil structure

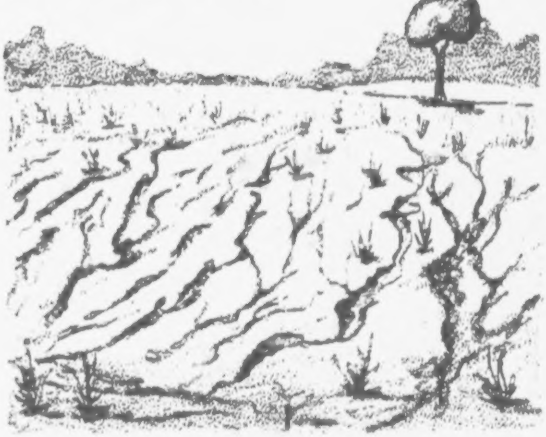
infiltration rate affects erosion due to runoff

EROSION CAUSED BY RUNNING WATER

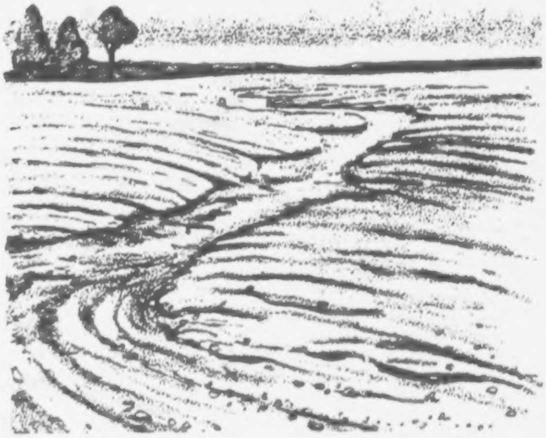
GULLY EROSION



RILL EROSION



SHEET EROSION



Factors Influencing Soil Erosion

A. Nature of the soil
   1. Texture
   2. Structure
   3. Depth of soil
   4. Organic matter content

B. Climate

C. Vegetative cover

D. Slope and horizontal length

E. Management of the soil

WIND EROSION ......

A. STRIP CROPPING

B. PREVENTION OF BURNING

C. PREVENTION OF GRAZING

D. MOISTURE CONSERVATION

E. EMERGENCY COVER CROPS

F. EMERGENCY TILLAGE OPERATIONS

G. WINDBREAK TREE PLANTING

H. SHELTER BELT OF TREES

..... CONTROL PRACTICES

WATER EROSION CONTROLS

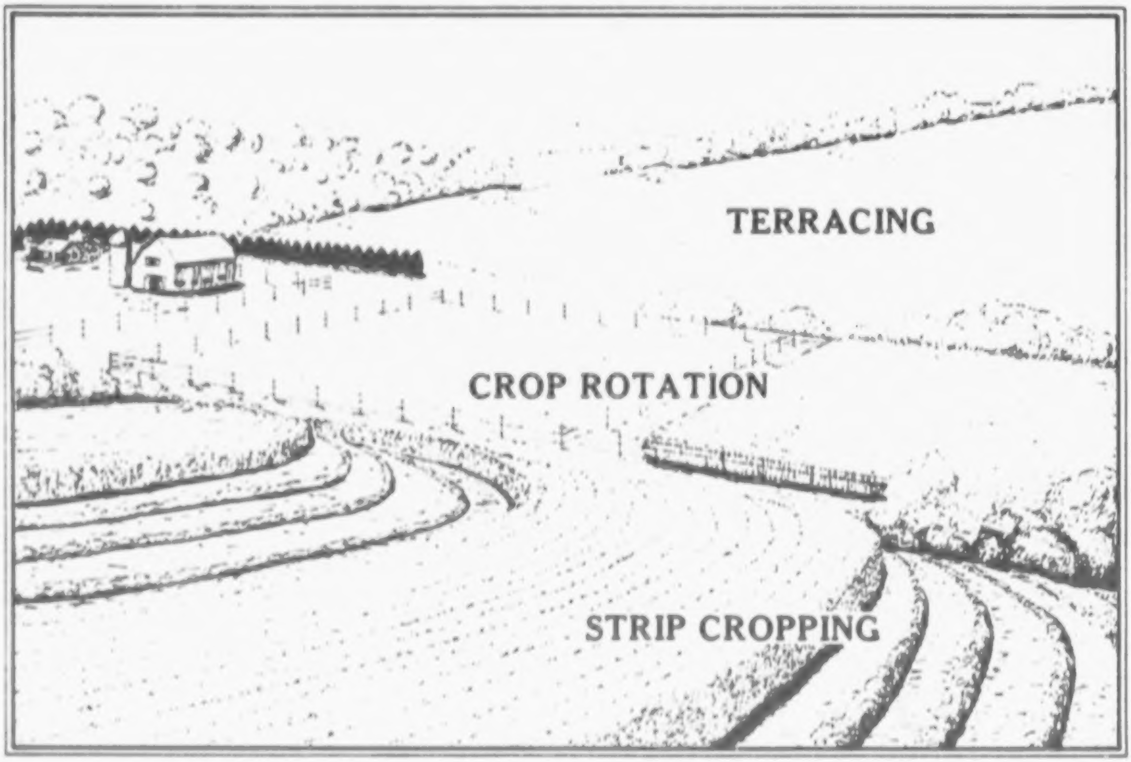
MECHANICAL

- TERRACING
- DIVERSIONS
- GRASSED WATERWAYS
- LAND DRAINAGE
- LAND PREPARATION (SHAPING, SMOOTHING, LEVELING)
- CONSTRUCTION OF PONDS & DAMS

CROPPING

- SUBSOILING OR CHISELING
- CONTOUR FURROWING
- CONTOUR LISTING
- STUBBLE MULCHING
- STRIP CROPPING

MANAGEMENT PRACTICES USED IN CONTROLLING EROSION


TERRACING
CROP ROTATION
STRIP CROPPING

SOIL CONSERVATION PRACTICES
UNIT 5

ASSIGNMENT SHEET #1 - HOW DO YOU RATE AS AN FFA CONSERVATIONIST?

Name____Score______________

Answer each of the questions below and on the following pages. Turn in to the instructor. If the question applies to you or your farming operation, answer YES; if it dos not apply to you, answer NO.

		YES	NO
1.	Are droughts on your farm less severe than they used to be?	☐	☐
2.	Can you cultivate as soon after a rain as you once could?	☐	☐
3.	Do the rains seem to soak into your soil faster and deeper than they once did?	☐	☐
4.	Do streams flood less frequently?	☐	☐
5.	Do your fields drain properly?	☐	☐
6.	Are your crop yields increasing?	☐	☐
7.	When you plow, does your soil seem darker in color than it was a few years ago?	☐	☐
8.	Do you notice fewer clay spots in the fields when you plow?	☐	☐
9.	Are gullies getting smaller in size and fewer in number?	☐	☐
10.	Does your soil drift against the fences less now than it once did?	☐	☐
11.	When you dig post holes, do you find plant roots all the way to the bottom of the holes?	☐	☐
12.	After a beating rain, does the surface of your soil still appear open and porous like a sponge?	☐	☐
13.	Is it becoming less difficult to prepare a good seedbed?	☐	☐
14.	Does your soil crust over less now than it once did?	☐	☐
15.	Do you spread manure on your land as fast as it is produced?	☐	☐

ASSIGNMENT SHEET #1

		YES	NO
32.	Do you have a home garden as good as any in your neighborhood?	☐	☐
33.	Have you had your soil tested on all gardens, fields, and pastures within the past three years?	☐	☐

Your rating as an FFA conservationist:

Total answers which are YES_____ NO____

I am Good . . . . . . (22-33 YES answers)
Fair . . . . . . (11-21 YES answers)
Poor . . . . . . (0-10 YES answers)

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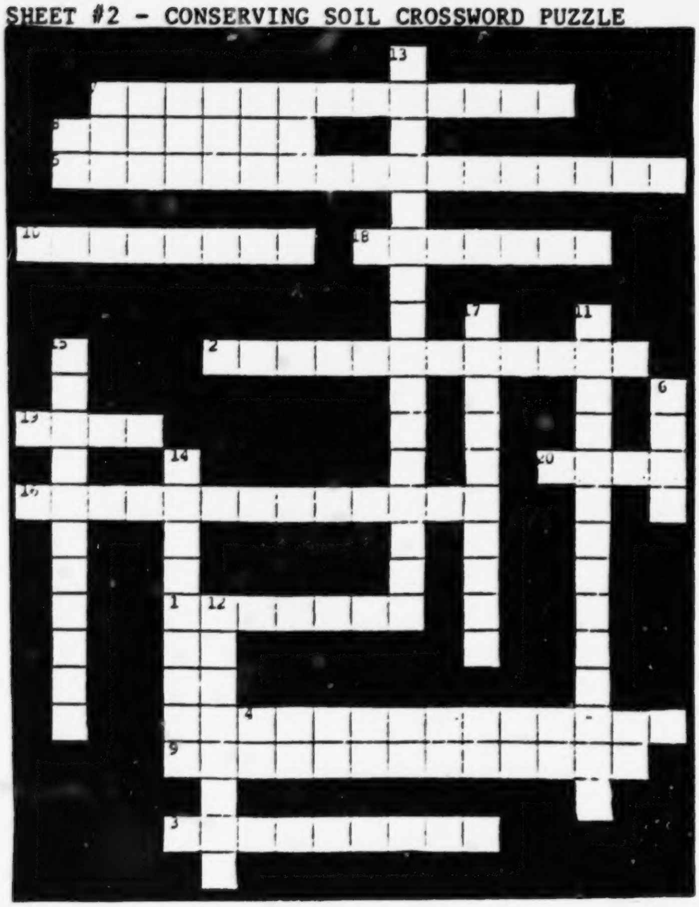
SOIL CONSERVATION PRACTICES
UNIT 5

ASSIGNMENT SHEET #2 - CONSERVING SOIL CROSSWORD PUZZLE



ACROSS

1. The wearing away of the soil by forces of water and wind.
2. Removal of soil in a uniform layer.
3. A crop grown to cover and protect the soil for a certain part of the year.
4. Advanced stage of rill erosion.
5. The wearing away of the soil by forces which are natural and without interference by man is called______________.
7. Erosion caused by raindrops.
8. Measure to intercept running water and move it around the slope or into a tile line.
9. Practice of planting strips of row crops with strips of meadow, small grains, etc. to slow down water.
10. Grassed ditch-like structure to carry excess water.
16. Soils with high _____ _____ content have increased absorption capacity.
18. ________is usually dark in color.
19. Structure to hold or impound water.
20. The natural medium for the growth of plants. A mixture of minerals, organic matter and reduce annual sod loss.

DOWN

6. _______ erosion is characterized by many small channels cut in to the soil by running water.
11. Farming around the slopes rather than up and down.
12. Alternating row crops with sod type crops to increase organic matter and reduce annual sod loss.
13. Office will give assistance free of charge for conservation planning.
14. A good ground cover (decreases, increases) water intake.
15. ____ _____ protects the soil's surface during parts of the season that crops are not grown.
17. The shape of the ground surface, as determined by major features such as hills, mountains, or plains.

SOIL CONSERVATION PRACTICES
UNIT 5

ASSIGNMENT SHEET #3 - LOCATING GOOD AND POOR CONSERVATION PRACTICES

Name______________________________Score__________

Survey your home community and list five examples of good conservation practices.

1.

2.

3.

4.

5.

List five examples of poor conservation practices

1.

2.

3.

4.

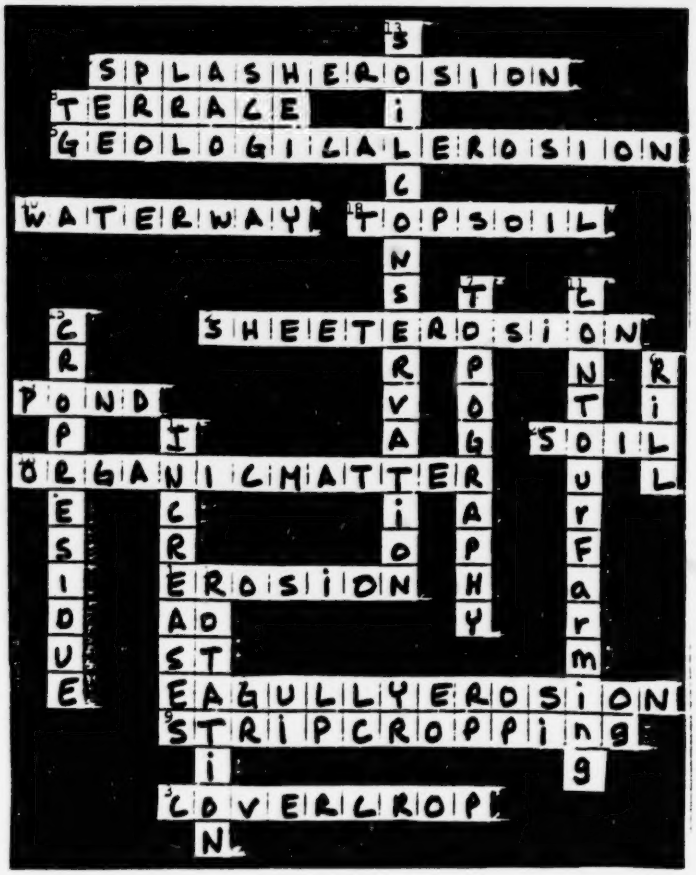
5.

SOIL CONSERVATION PRACTICES
UNIT 5

ANSWERS TO ASSIGNMENT SHEETS

1. Evaluated to satisfaction of instructor.

2.


SPLASHEROSION
TERRACE
GEOLOGILALEROSION
WATERWAY
TOPSOIL
SHEETEROSION
POND
SOIL
ORGANICMATTER
EROSION
GULLYEROSION
STRIPCROPPING
COVERCROP
CONSERVATION
TOPOGRAPHY
CONTOURFARMING
RILL
CROPRESIDUE
INCREASE
ROTATION

3. Evaluated to satisfaction of instructor.

SOIL CONSERVATION PRACTICES
UNIT 5

TEST

Name____Score______________

1. Match terms associated with soil conservation practices to the correct definitions. Write the correct numbers in the blanks.

1.	Erosion	5.	Strip-cropping
2.	Water outlet	6.	Diversion ditch
3.	Terracing	7.	Cover crop
4.	Crop rotation		

_____a. Rotation of crops on a field from one crop to another

_____b. Ditch which prevents erosion by diverting water around a field rather than across

_____c. Removal of soil by tillage, wind and/or water

_____d. Structure designed to slow down running water and control erosion on sloping land

_____e. Crop used to cover the soil surface to decrease erosion

_____f. Practice of growing soil-conserving and soil-depleting crops in alternate strips for the purpose of reducing erosion

_____g. Ditch which carries excess water from farm

2. Name two types of erosion

a. ____

b. ____

3. Match the categories of water erosion to the correct description. Write the correct numbers in the blanks.

1.	Splash	3.	Rill
2.	Sheet	4.	Gully

_____a. Small channels are made by running water over the surface of the soil

_____b. The removal of soil in a uniform layer from an entire surface area

_____c. Caused by the effect of falling raindrops

_____d. An advanced stage of rill erosion and occurs when rills flow together into larger streams; cannot be crossed by equipment

TEST

_____e. Windbreak tree planting

_____f. Strip-cropping

_____g. Terracing

_____h. Crop rotation

_____i. Contour furrowing

_____j. Chiseling

7. Select from the following list factors that determine the type of cropping system to use. Write an "X" in the blank before each correct answer.

_____a. Slope

_____b. Erodibility

_____c. Drainage

_____d. Moisture

_____e. Soil depth

_____f. Fertility

_____g. Economics

8. Name two organizations involved with soil conservation.

a. ______________________________

b. ______________________________

SOIL CONSERVATION PRACTICES
UNIT 5

ANSWERS TO UNIT TEST

1. a. 4
   b. 2
   c. 1
   d. 3
   e. 7
   f. 5
   g. 2

2. water, wind, tillage

3. a. 3 b. 2 c. 1 d. 4

4. a, b, c, e, f, g, h

5. a, d, e, f

6. a, b, c, f, g, h, i, j

7. a, b, c, d, e, f, g

8. Any of the following: Soil Conservation Service, Agricultural Stabilization and Conservation Service, local soil and water conservation districts.

LAND JUDGING
UNIT 6

UNIT OBJECTIVE

After completion of this unit, the student should be able to judge land, recommend land treatments and complete the scorecard for land judging or homesite evaluation. This knowledge will be shown through demonstration and by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with land judging to the correct definition.
2. List three reasons for judging land.
3. Select from a list factors considered in determining land capability class.
4. Name the three major groups of soil in relation to texture.
5. Discuss the means of determining soil texture by touch.
6. Match the different variations of permeability, depth, slope, erosion, surface runoff, drainage and climate to the identifying characteristics of each.
7. Match the land capability class to the correct description.
8. Select, when given six land factors, the best land class possible for the specified field.
9. Select the recommended vegetative land treatments when given the land capability class.
10. Select the recommended mechanical land treatments when given the land capability class.
11. Select the correct fertilizer and soil amendments needed from soil test information provided.
12. Select from a list factors considered in homesite evaluation.

LAND JUDGING
UNIT 6

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials planned to supplement unit

    1. Literature

      a. Land Judging Contest, Washington State FFA Awards Manual, pages 153-190; Order from: SPI, Agriculture Education, Room 241, Old Capital Bldg, Olympia, WA 98504

      b. Soils Manual for Land Judging, a 58-page illustrated manual. Order from Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA, 93407. Approximate cost $9.15 each.

    2. Filmstrips, slideshows, etc.

      a. Land Judging Slides--set of 72 slides with script. The slides give a complete overview of land judging school and contest rules. Available from CIMC, Oklahoma State Dept. of Voc-Tech Educ., 1500 w. 7th Ave., Stillwater, OK, 74074. Approximate cost $22.00.

    3. Films

  B. Make transparencies

  C. Provide students with objective sheet

   9. TM 9--Land capability classes
   10. TM 10--Land capability
   11. TM 11--Major factors that keep area out of class 1
   12. TM 12--Land use according to capabilities

E. Assignment sheets
   1. Completing Washington land judging scorecard
   2. Completing homesite evaluation scorecard

F. Test

G. Answers to test

III. Unit references

A. Instructional Materials for Vocational Agriculture, College Station, Texas: Teaching Materials Center, Agriculture Education Department, Texas A & M University.

B. Oklahoma Curriculum Guide for Vocational Agriculture, Stillwater, OK: Oklahoma State Board for Vocational-Technical Education, Curriculum and Instructional Materials Center.

LAND JUDGING
UNIT 6

INFORMATION SHEET

I. Terms and definitions

A. Surface texture--Texture of the surface soil or "A" horizon; proportion of sand, silt, and clay that makes up the surface soil

B. Sand--(0.05 to 2 mm) The gritty material which you can feel when you rub the soil with your finger; individual grains can be seen or felt

C. Silt--(0.002 to 0.05 mm) The floury material which you can feel when you rub the soil with your finger; it is not gritty and not sticky when wet

D. Clay--(less than 0.002 mm) Forms lumps or clods when dry and is plastic and sticky when wet; when pinched out between the thumb and finger will form a long flexible "ribbon"

E. Soil pores--Total space not occupied by soil particles in a bulk volume of soil

F. Hard pan--A hardened soil layer in the lower A or deeper horizon not readily penetrated by plant roots or water

G. Bulk density--The weight of dry soil per unit bulk volume, e.g. grams per cm^3 or pound per cubic foot

H. Soil structure--Way that individual soil particles are grouped together to form clusters of particles

I. Topsoil or "A" horizon--Surface, dark-colored upper layer of natural soil; zone in which seeds are planted and cultivated; main storehouse for minerals and moisture

J. Subsoil--Layer found just below the topsoil; the "B" horizon; also a storehouse for moisture and minerals

K. Permeability--Rate at which air and water move through the soil

L. Soil depth--Total thickness of soil layers readily penetrated by roots

M. Slope--A measurement of difference in elevation from one point to another; it is generally referred to as percent - the number of feet difference in elevation for 100 feet of horizontal distance

N. Erosion--Loss of soil by the actions of tillage, wind and/or water

INFORMATION SHEET

D. Slope

E. Erosion

(Note: This includes wind and water.)

F. Surface runoff

G. Drainage

H. Climate

IV. Major groups of soil in relation to texture

A. Sandy soils--Includes coarse textured, very sandy soils

B. Loamy soils--Includes moderately coarse, medium textured, and moderately fine textured soils.

C. Clayey soils--Includes fine textured soils

(Note: Refer to textural triangle for specific textural classes that fall into these groups.)

V. Determining soil texture by touch (Transparency #2)

(Note: Soil texture can be determined by touch with the aid of water by working or feeling the soil between fingers and thumb. Refer to Unit 1 - Elementary Study of Soils, Job Sheet #2 for additional information.)

A. Sandy soils--When rubbed between fingers this soil has a rough, gritty feeling; individual grains can be seen or felt

B. Loamy soils--When rubbed between the fingers this soil has a touch of velvet or the feel of wheat flour; it is not gritty and not sticky when wet

C. Clayey soils--Forms very hard lumps or clods when dry and is sticky when wet; when pinched out between the thumb and finger will form a long flexible "ribbon"

VI. Important soil and land characteristics

A. Permeability of subsoil (Transparencies #3 and #4)

1. Very slow--Less than 0.06 in/hr; soils that have dense heavy clay or clay pan subsoil

2. Slow--0.06 to 0.2 in/hr; soils that have crumbly, clayey subsoil

INFORMATION SHEET

D. Erosion (Transparency #7)

(Note: Evaluation of the site for land judging will be based on past erosion. Original topsoil depth can be found on the site placard and compared to present depth of topsoil to calculate the percent lost. The present topsoil can be determined by dark color, presence of organic matter and soil structure.)

1. None to slight--Less than 25% of the surface soil is removed with no gullies and/or little deposition by wind and water

2. Moderate--25 to 75% of the surface soil removed with or without gullies and/or moderate deposition by wind and water

3. Severe--More than 75% of the surface soil removed with occasional uncrossable gullies and/or severe accumulation or blowouts by wind

E. Surface runoff (Transparency #8)

(Note: Surface runoff occurs from a combination of natural factors including land slope and water infiltration rate of the soils. Runoff causes erosion--loss of water, loss of soil, loss of nutrients. Lack of runoff causes ponding and excess water in the soil profile.)

1. Rapid--Surface water flows rapidly; fields with slopes of 25% and above (except rapidly permeable soils) would go in this category

2. Moderate--Normal runoff from soils with slopes of 3 to 25% (except rapidly permeable soils)

3. Slow--Surface water flows away slowly; surplus water on clayey soils is an occasional problem; can include nearly level areas (from 0 to 3% slope) with moderately permeable subsoil

4. Very slow--Surface water flows away very slowly; includes soils on nearly level slopes (with clayey, surface texture or sandy texture soils with rapidly permeable subsoil)

F. Drainage

(Note: Drainage is the ability of the subsoil to permit the downward flow of excess water to allow good aeration.)

1. Excessive--Excess amounts drain away quickly causing droughty conditions; includes only rapidly permeable soils

INFORMATION SHEET

B. Land not suited for cultivation

1. Class V--Soils having little or no erosion hazards, but having other limitations that are impractical to remove that limits their use largely to pasture, range, woodland or wildlife food and cover; these include very poor drainage with wet, poorly drained profiles or frequent flood areas

2. Class VI--Soils having severe limitations that make them generally unsuited for cultivation and limits their use largely to pasture or range, woodland, or wildlife food and cover

3. Class VII--Soils having very severe limitations that make them unsuited for cultivation and restricts their use largely to grazing, woodland, or wildlife habitat

C. Land not suited for cultivation, grazing, or forestry

1. Class VIII--Soils and land forms having limitations that preclude their use for commercial plant production and restrict their use to wildlife, recreation, water supply, or scenic purposes

VIII. General guide for selecting land capability class

Soil factor	Best land class possible
A. Surface texture	
Sandy	IV
Loamy	I
Clayey	III
B. Permeability	
Rapid	III
Moderate	I
Slow	II
Very Slow	III
C. Depth - surface and subsoil	
Very deep	I
Deep	I
Moderately deep	II
Shallow	IV
Very shallow	VI

INFORMATION SHEET

IX. Vegetative land treatments

- A. Practices for cropland use
  - 1. Every 4th or 5th year -- Class I land
  - 2. Every 3rd or 4th year -- Class II land
  - 3. Every 2nd year -- Class III land
  - 4. Every year -- Class IV land
  - 5. Do not burn crop residue -- Class I - IV land
  - 6. Residue management -- Class I - IV land
- B. Treatments and practices
  - 1. Class I -- Practices 1, 5, and 6
  - 2. Class II -- Practices 2, 5, and 6
  - 3. Class III -- Practices 3, 5, and 6
  - 4. Class IV -- Practices 4, 5 and 6
- C. Practices for pasture, range, wildlife, or woodlands
  - 7. Establish recommended grass -- Class V, VI, and VII lands
  - 8. Proper pasture and range management -- Class V, VI, and VII lands
  - 9. Protect from burning -- Class VI and VII
  - 10. Control grazing -- Class V, VI, and VII lands
  - 11. Plant recommended trees
  - 12. Harvest tree selectively
  - 13. Use only for wildlife or recreation area -- Class VII land
- D. Treatments and Practices
  - 1. Class V -- Practices 7,8,9, and 10
  - 2. Class VI -- Practices 7,8,9, and 10

INFORMATION SHEET

XI. Fertilizers and soil amendments

A. Nitrogen--Add if field card indicates deficiency

B. Phosphorus--Add when values are less than 10 ppm

C. Potassium--Add when values are less than 150 ppm

D. PH -- Check practice no. 21 if PH value less than 6

XII. Factors considered in homesite evaluation

A. Soil depth

B. Seasonal high water table

C. Flooding

D. Slope

E. Permeability

F. Shrink - swell

G. Texture - surface

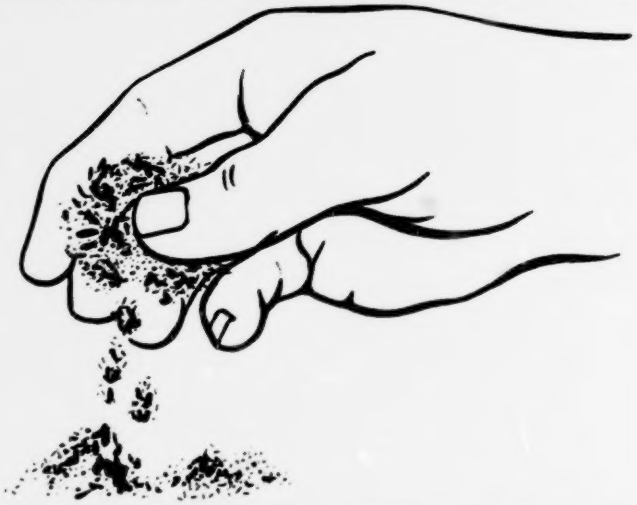
(Note: Refer to section on "How to Use the Homesite Evaluation Scorecard" in State FFA Awards Manual for more information on using and completing the Homesite Evaluation Scorecard.

Factors Determining Land Capability Class

A. Surface texture
B. Permeability
C. Depth of soil
D. Slope
E. Erosion
F. Surface runoff
G. Drainage
H. Climate

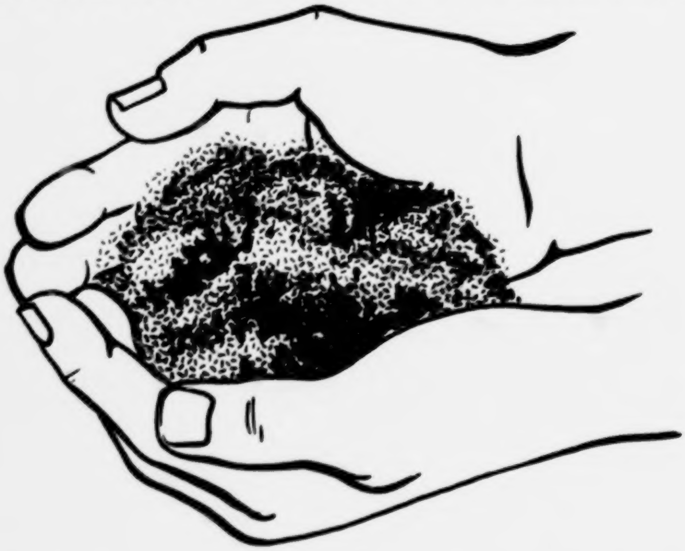
DETERMINING Soil Texture

RUB TOPSOIL BETWEEN THUMB AND FINGERS TO FEEL WHETHER IT IS SANDY, LOAMY, OR CLAYEY



SOIL TEXTURE		
SANDY	░	COARSE-GRITTY FEEL
LOAMY	▒	MEDIUM-SILTY, FLOURY FEEL
CLAYEY	▓	FINE-STICKY WHEN WET

DETERMINING SOIL PERMEABILITY



HANDLE SUBSOIL TO DETERMINE IF SUBSOIL IS LOOSE, CRUMBLY, DENSE OR TIGHT

and

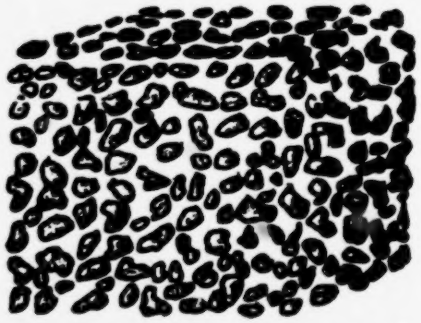
ESTIMATE SOIL PERMEABILITY OR MOVEMENT OF AIR AND WATER IN SUBSOIL

RATE	SOIL TEXTURE
RAPID	LOOSE, SANDY
MODERATE	LOAMY
SLOW	CRUMBLY, CLAYEY
VERY SLOW	DENSE, HEAVY CLAY

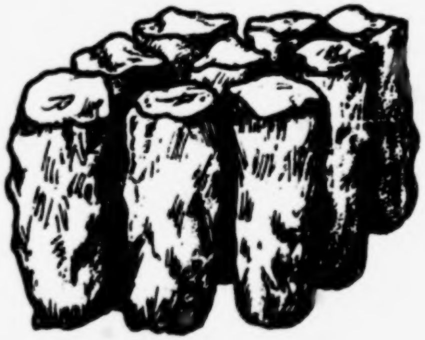
Soil Permeability

"B" HORIZON (SUBSOIL)

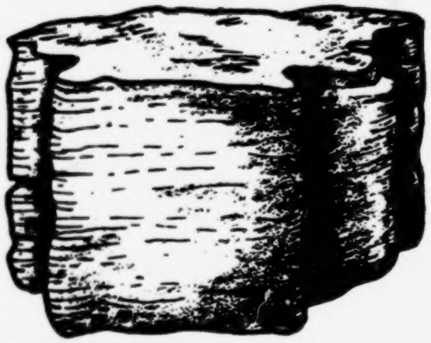
FACTORS DETERMINING PERMEABILITY CLASSIFICATION ARE:
SIZE - SHAPE - STRENGTH - ARRANGEMENT OF SOIL AGGREGATES



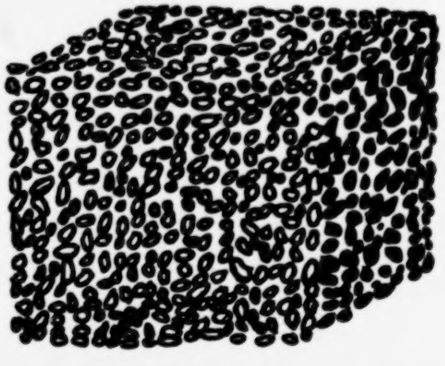
GRANULAR



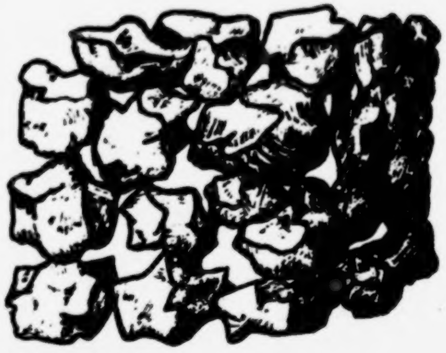
PRISMATIC



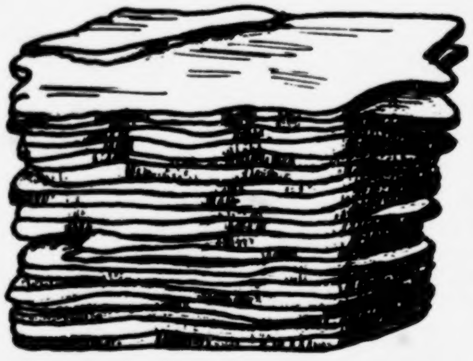
MASSIVE



SINGLE GRAIN



BLOCKY



PLATY

RAPID

MODERATE

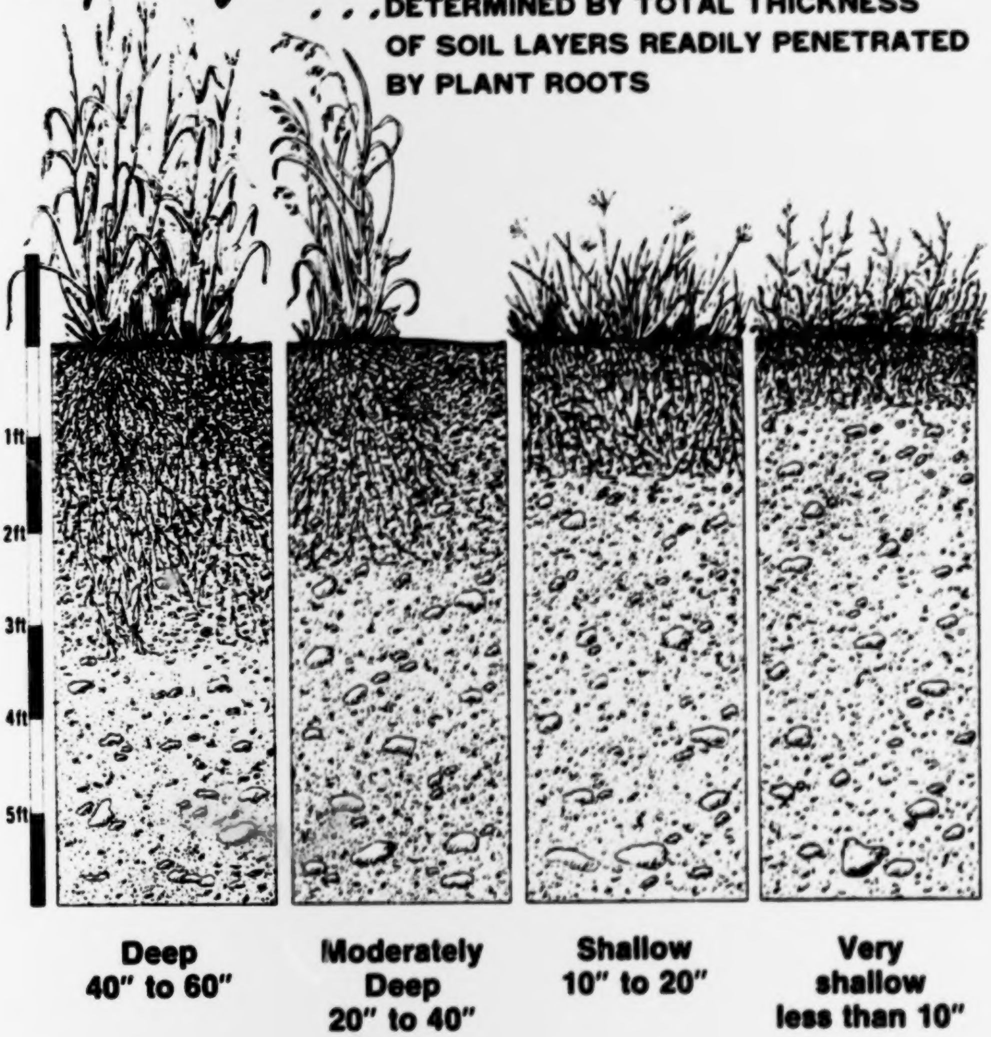
SLOW OR VERY SLOW

TM #4

CSS 6 19

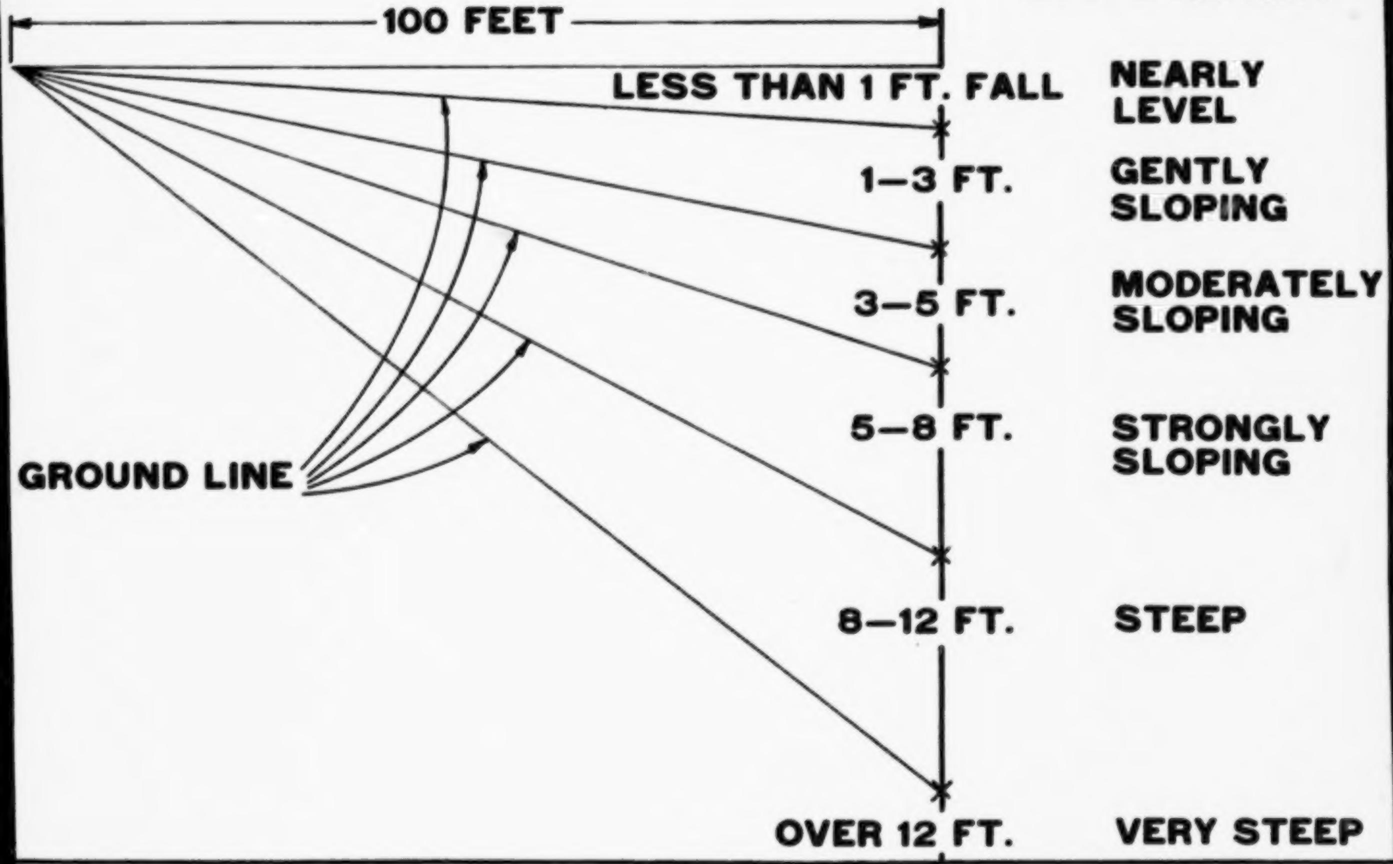
Depth of Soil. . .

. . . DETERMINED BY TOTAL THICKNESS OF SOIL LAYERS READILY PENETRATED BY PLANT ROOTS


1ft
2ft
3ft
4ft
5ft
Deep
40" to 60"
Moderately
Deep
20" to 40"
Shallow
10" to 20"
Very
shallow
less than 10"

SLOPE

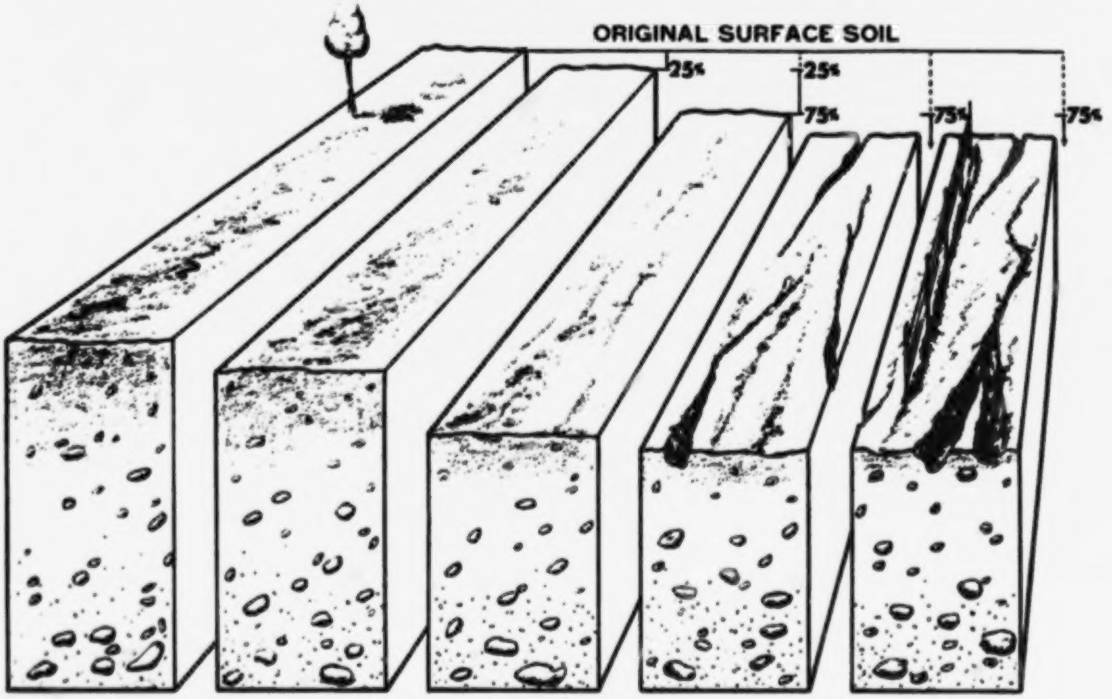
DETERMINED BY THE NUMBER OF FEET FALL IN EACH 100 FEET



	SLOPE RANGES
LESS THAN 1 FT. FALL	NEARLY LEVEL
1–3 FT.	GENTLY SLOPING
3–5 FT.	MODERATELY SLOPING
5–8 FT.	STRONGLY SLOPING
8–12 FT.	STEEP
OVER 12 FT.	VERY STEEP

Water & Wind Erosion

IN DETERMINING EROSION CLASSIFICATION, OBSERVE THICKNESS OF REMAINING TOPSOIL AND COMPARE WITH ORIGINAL THICKNESS AS FURNISHED FROM INFORMATION SHEET



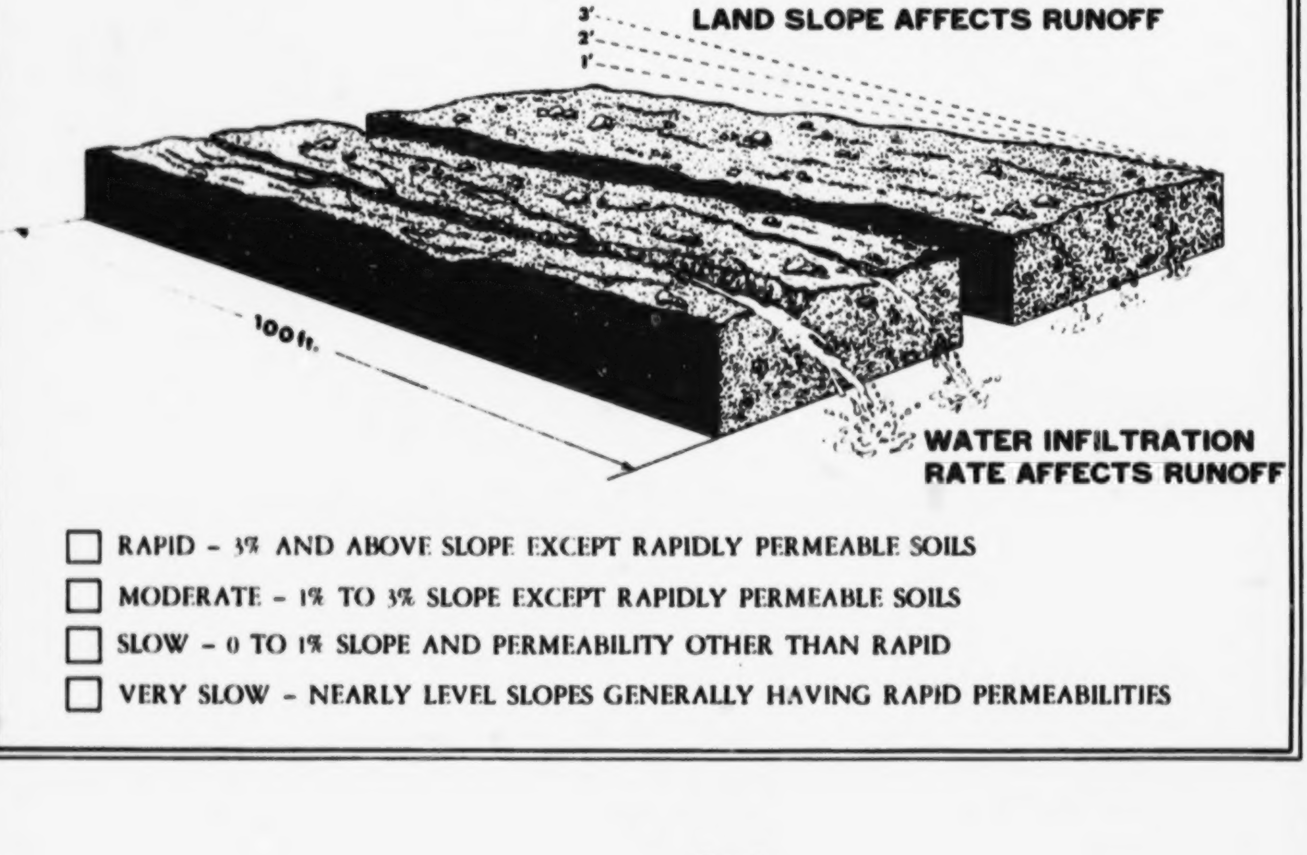
NONE TO SLIGHT – – LESS THAN 25% (WITH NO GULLIES)

MODERATE – – 25% TO 75% (WITHOUT FREQUENT UNCROSSABLE GULLIES)

SEVERE – – 75% OR MORE (WITH OR WITHOUT OCCASIONAL UNCROSSABLE GULLIES)

VERY SEVERE – – 75% OR MORE (WITH FREQUENT UNCROSSABLE GULLIES AND/OR SEVERE ACCUMULATIONS BY WIND)

Surface Runoff


3'
2'
1'
LAND SLOPE AFFECTS RUNOFF
100 ft.
WATER INFILTRATION RATE AFFECTS RUNOFF

☐ RAPID - 3% AND ABOVE SLOPE EXCEPT RAPIDLY PERMEABLE SOILS

☐ MODERATE - 1% TO 3% SLOPE EXCEPT RAPIDLY PERMEABLE SOILS

☐ SLOW - 0 TO 1% SLOPE AND PERMEABILITY OTHER THAN RAPID

☐ VERY SLOW - NEARLY LEVEL SLOPES GENERALLY HAVING RAPID PERMEABILITIES

LAND CAPABILITY CLASSES

SUITABLE FOR CULTIVATION

I REQUIRES GOOD SOIL MANAGEMENT PRACTICES ONLY

II MODERATE CONSERVATION PRACTICES NECESSARY

III INTENSIVE CONSERVATION PRACTICES NECESSARY

IV PERENNIAL VEGETATION - INFREQUENT CULTIVATION

UNSUITABLE FOR CULTIVATION; BUT SUITABLE FOR GRAZING, FORESTRY, AND WILDLIFE FOOD AND COVER

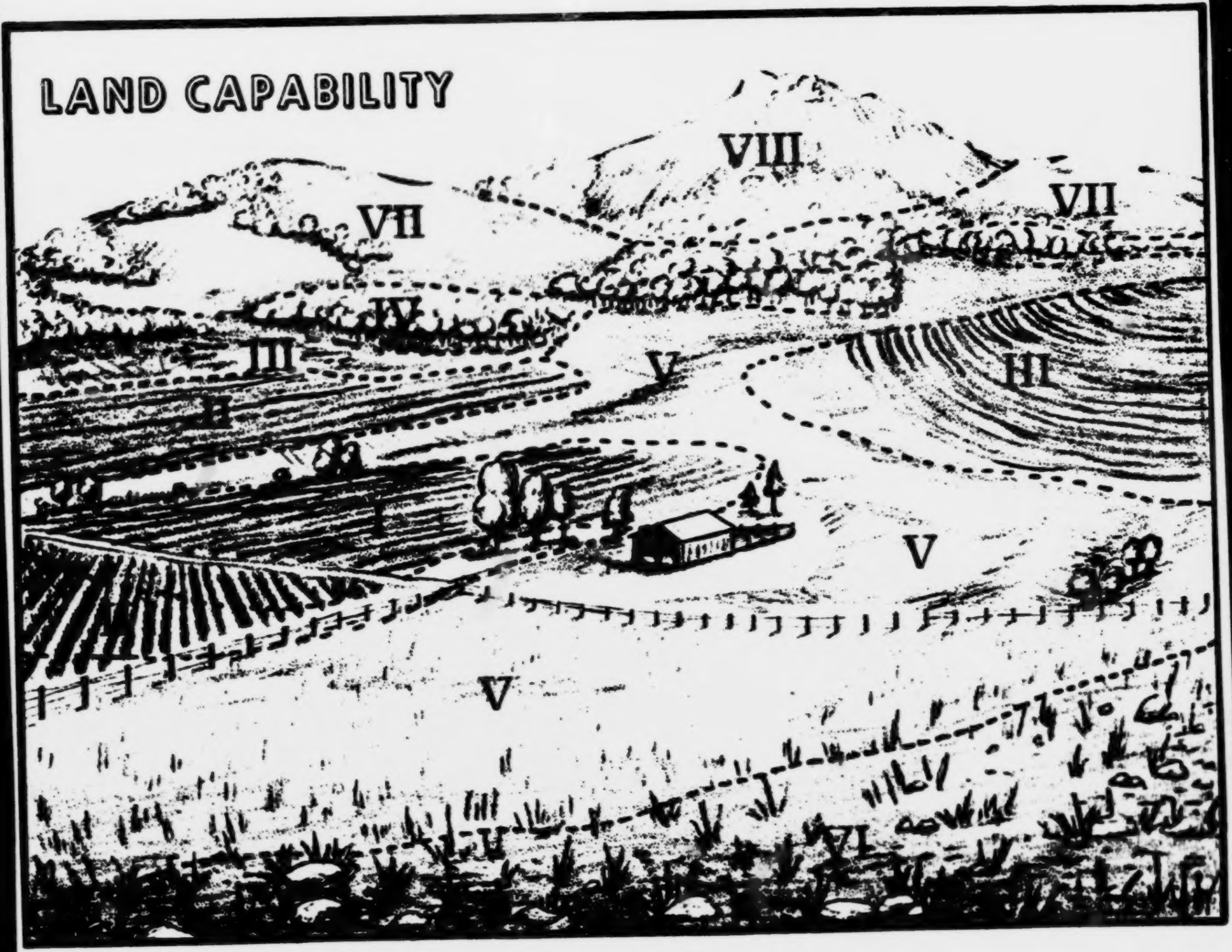
V LIMITED RESTRICTIONS IN USE, USUALLY POORLY DRAINED OR SUBJECT TO OVERFLOW

VI MODERATE RESTRICTIONS IN USE

VII SEVERE RESTRICTIONS

UNSUITABLE FOR CULTIVATION, GRAZING, OR FORESTRY

VIII EXTREME RESTRICTIONS FOR RECREATION, WILDLIFE, WATER SUPPLY, OR AESTHETIC PURPOSES


LAND CAPABILITY
VIII
VII
VII
IV
III
V
III
II
I
V
V
VI

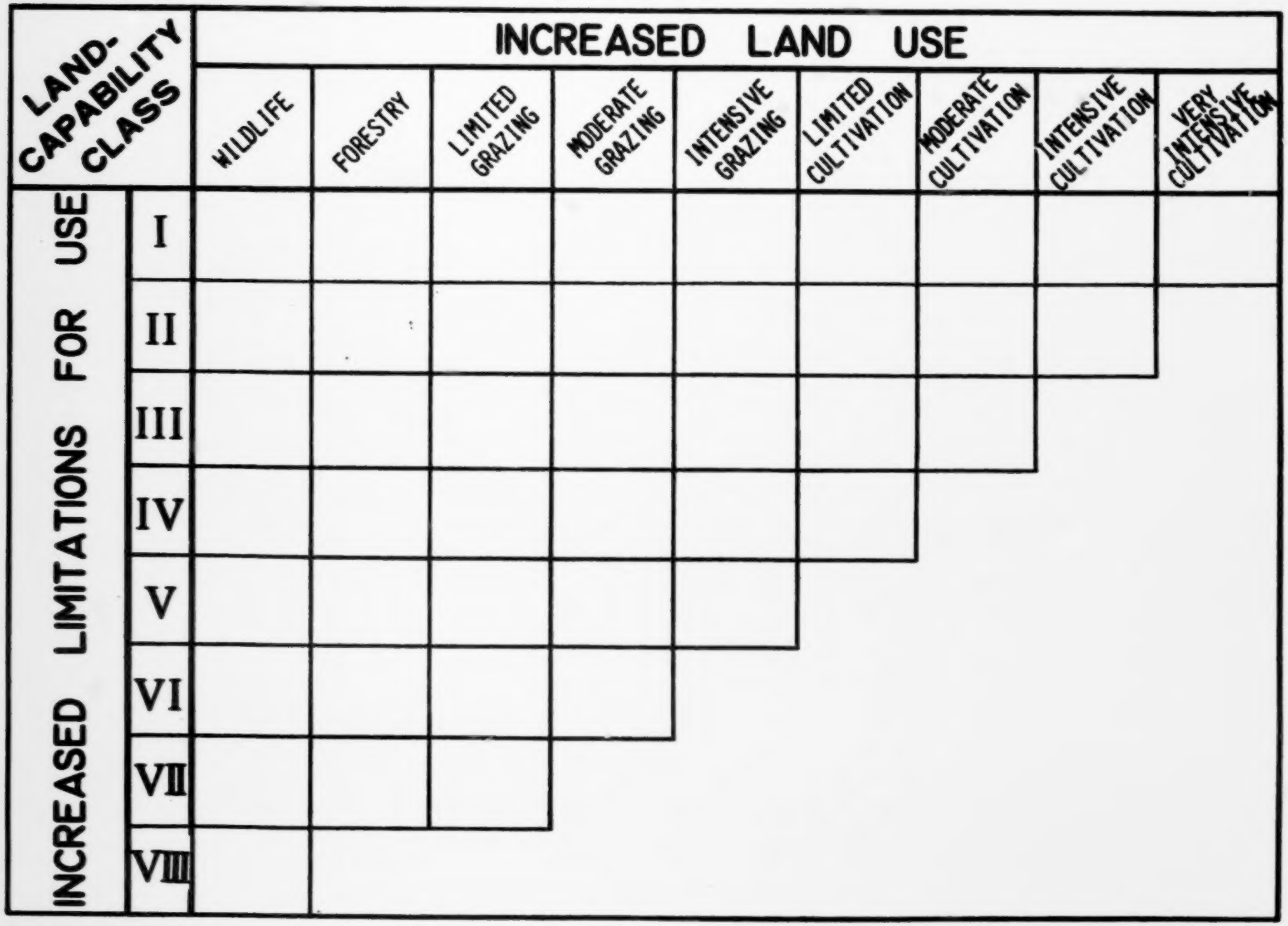
Major Factors That Keep Area Out of Class 1

☐ 1. Texture
☐ 2. Permeability
☐ 3. Depth
☐ 4. Slope
☐ 5. Erosion
☐ 6. Runoff
☐ 7. Drainage
☐ 8. Climate
☐ 9. None

(✓) all factors that would prevent the land area from being class 1

*Class 1 land will not have any factors checked

LAND USE ACCORDING TO CAPABILITIES


LAND-CAPABILITY CLASS
INCREASED LAND USE
WILDLIFE
FORESTRY
LIMITED GRAZING
MODERATE GRAZING
INTENSIVE GRAZING
LIMITED CULTIVATION
MODERATE CULTIVATION
INTENSIVE CULTIVATION
VERY INTENSIVE CULTIVATION
INCREASED LIMITATIONS FOR USE
I
II
III
IV
V
VI
VII
VIII

TM #12

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LAND JUDGING
UNIT 6

ASSIGNMENT SHEET #1 - COMPLETING WASHINGTON LAND JUDGING SCORECARD

Name____Score_______________

Apply the following land class factors and field conditions to the judging scorecard:

1. Texture--Feel of wheat flour
2. Permeability--Granular, clay loam
3. Depth--Twenty-six inches
4. Slope--Three and one-half foot fall in each 100 feet
5. Erosion--Thirty percent of topsoil removed, no gullies
6. Drainage--Root zone saturated with water limited to 1 week
7. Climate--120 days, irrigation water available
8. Soil test results
    a. pH--6.0
    b. N--25 ppm
    c. P--8 ppm
    d. K--250 ppm
    e. Zn--0.8 ppm

LAND JUDGING
UNIT 6

ASSIGNMENT SHEET #2 - COMPLETING WASHINGTON HOMESITE EVALUATION LAND JUDGING SCORECARD

Name______________________________________Score______________

Apply the following homesite soil factors and conditions to the judging scorecard:

1. Texture--Moderately gritty
2. Permeability--Soft blocky, sandy loam
3. Soil Depth--Fifty-five inches
4. Slope--Two foot fall in each 100 feet
5. Erosion--Sixty percent of topsoil removed, no gullies
6. Water table--None evident above 72 inches
7. Flooding--No flooding

LAND JUDGING
UNIT 6

TEST

Name____Score______________

1. Match terms associated with land judging to the correct definition. Write the correct numbers in the blanks.

1. Surface texture
2. Sand
3. Silt
4. Clay
5. Soil pores
6. Hard pan
7. Bulk density
8. Soil structure
9. Topsoil
10. Subsoil
11. Permeability
12. Soil depth
13. Slope
14. Erosion
15. Surface runoff
16. Drainage
17. Climate
18. Land capability class
19. Soil conserving crop
20. Soil improving crop

_____a. Relative rate water is removed by flow over the soil surface

_____b. Total thickness of topsoil and subsoil readily penetrated by roots

_____c. Crops that prevent or retard erosion and tend to maintain rather than deplete soil organic matter

_____d. The number of feet difference in elevation for 100 feet of horizontal distance

_____e. Grouping of different soils according to productive capacity, use, management, and conservation treatment necessary to minimize erosion

_____f. Crops that improve or replenish rather than deplete soil organic matter

_____g. Rate at which air and water move through the soil

_____h. Surface, dark-colored upper layer of natural soil; "A" horizon

_____i. Layer found just below the topsoil; "B" horizon

_____j. Loss of soil by actions of tillage, wind and/or water

_____k. Way that individual soil particles are grouped together to form clusters of particles

_____l. Proportion of sand, silt and clay that makes up the surface soil

TEST

4. Name the three major groups of soil in relation to texture.

   a. ____

   b. ____

   c. ____

5. Discuss in a short paragraph the means of determining soil texture by touch.

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

6. Match the different variations of permeability, depth, slope, erosion, surface runoff, drainage and climate to the correct definition. Write the correct numbers in the blanks.

   A. Permeability

   1. Very slow 3. Moderate
   2. Slow 4. Rapid

   _____a. Soils that have sandy subsoil

   _____b. Soils that have highly granular, clay loam subsoil

   _____c. Soils that have dense heavy clay or clay pan subsoil

   _____d. Soils that have crumbly, clayey subsoil

TEST

E. Drainage

1. Excessive	3. Somewhat poor
2. Good	4. Poor

_____a. Excess amounts drain away quickly causing droughty conditions; rapidly permeable soils

_____b. Saturation with water in root zone limited to 1 or 2 weeks; will injure plant roots

_____c. Saturation with water in root zone for more than 2 weeks; severely injure plant roots so that yield is greatly reduced

_____d. Saturation with water in root zone limited to a few days; plant roots are not injured

F. Climate

1. Good
2. Fair
3. Poor

_____a. Less that 100 frost-free days or less than 10 inches of average annual precipitatin with irrigation water unavailable

_____b. More than 140 frost-free days with more than 10 inches of average annual precipitation or irrigation water available

_____c. 100 to 140 frost-free days along with more than 10 inches of average annual precipitation or irrigation water available

TEST

9. Select the recommended vegetative land treatments for non-irrigated Class III land that has a moderate erosion problem. Write an "X" in the blank before each correct treatment.

_____a. Soil conserving and/or improving crops not necessary

_____b. Use soil conserving and/or improving crops every 4-5th year

_____c. Use soil conserving and/or improving crops every 3-4th year

_____d. Use soil conserving and/or improving crops every 2nd-3rd year

_____e. Crop residue use

_____f. Weed control

_____g. Strip cropping

_____h. Brush and tree control

_____i. Grasses and legumes

_____j. Pasture, range, hay management

_____k. Tree planting

_____l. Woodland harvest cutting

_____m. Wildlife, recreation and watershed

10. Select the recommended mechanical land treatments for irrigated Class II with an excessive surface runoff problem. Write an "X" in the blank before each correct treatment.

_____a. Land leveling and smoothing

_____b. Irrigation water management

_____c. Water control structure

_____d. Diversion or terrace

_____e. Contour farming

_____f. Grass waterway

_____g. Subsurface drainage system

_____h. Minimum tillage

TEST

12. Select from the following list factors considered in homesite evaluation. Write an "X" in the blank before each correct answer.

_____a. Surface texture

_____b. Permeability

_____c. Depth of soil

_____d. Slope

_____e. Erosion

_____f. Surface runoff

_____g. Shrink-swell

_____h. Water table

_____i. Flooding

_____j. Land capability class

LAND JUDGING
UNIT 6

ANSWERS TO UNIT TEST

1. a. 15
b. 12
c. 19
d. 13
e. 18
f. 20
g. 11
h. 9
i. 10
j. 14
k. 8
l. 1
m. 4
n. 6
o. 17
p. 2
q. 16
r. 5
s. 3

2. Any three of the following:

A. Aid in understanding and importance of basic soil differences as they affect crop production and erosion.
B. Helps one to determine management practices important to proper use of soil and water.
C. Develops understanding of different soil and water conservation practices.
D. Aids in understanding the influence of land features on production and land protection.
E. Aids in selecting a farm for purchase.

3. a, b, c, d, e, f, g, h

4. a. Sandy b. Loamy c. Clayey

5. Evaluated to satisfaction of instructor.

6. A. a.4 b.3 c.1 d. 2
B. a.2 b.5 c.1 d. 4 e. 3
C. a.2 b.3 c.1
D. a.2 b.1 c.3 d.4
E. a.1 b.3 c.4 d.2
F. a.3 b.2 c.1

7. a. 7
b. 1
c. 3
d. 8
e. 5
f. 2
g. 4
h. 6

8. a. I
b. III
c. II
d. IV
e. VI
f. II

9. c, e, g

10. b, c, h

11. a, b, g

12. a, b, c, d, e, f, g, h, i

INTRODUCTION TO CROP SCIENCE
UNIT 7

UNIT OBJECTIVE

After completing this unit, the student should be able to discuss the importance of plants and crop production. The student should be able to list the major crops of Washington and the U.S. They should be able to classify plants and discuss factors affecting crop production. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with crop science to the correct definitions.
2. Select from a list necessities that are furnished by plants.
3. Select from a list crops of Washington that rank in the top three in production in the United States.
4. Name five major crops grown in the U.S.
5. Classify plants by matching them with the correct class.
6. Match the category of land use in the U.S. with the correct percentage.
7. Match common crops of Washington with their average yields.
8. List four factors that affect the amount of crop that can be produced.

INTRODUCTION TO CROP SCIENCE
UNIT 7

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit

      1. Literature

      2. Filmstrips, slideshows, etc.

      3. Films

   B. Make transparencies

   C. Provide students with objective sheet

   D. Provide students with information sheet

   E. Discuss unit and specific objectives

   F. Discuss information sheet

   G. Construct and administer pretest on crop science

   H. Invite someone to speak on careers in crop science

   I. Give test

   J. Reteach, if necessary

   K. Retest

INTRODUCTION TO CROP SCIENCE
UNIT 7

INFORMATION SHEET

I. Terms and definitions

   A. Agronomy--Science of crop production and soil management

   B. Arable land--Land which is capable in its present condition of producing crops requiring tillage

   C. Arid climate--Climate in which the annual rainfall is less than 10 inches

   D. Cereal--Grass grown to be used for feed or seed

   E. Forage--Livestock feed, such as pasture, hay or silage

   F. Legume--Soil improving plant which manufactures nitrogen

   G. Pulse--Leguminous plants or their seeds; this includes chiefly those plants with large seed used for food

   H. Range--Extensive area of natural pasture land

   I. Weed--Undesirable plant growing with a crop

   J. Native plant--Plant originating in North America

   K. Introduced plant--Plant brought in from countries outside the United States

   L. Cwt--Hundred weight, 100 pounds

   M. Bushel--Thirty-two dry quarts; a common measurement for small grains

   N. Ton--Two-thousand pounds; a common measurement for forage, sugarbeets and sweet corn

II. Plants furnish the following necessities (Transparency #1)

   A. Oxygen for man and animals to breathe

   B. Fuel for heating and transportation

   C. Building materials

   D. Medicine and drugs

   E. Food for man and animal nutrition

INFORMATION SHEET

IV. Major Crops of the U.S.

- A. Corn
- B. Wheat (winter and spring)
- C. Oats
- D. Barley
- E. Rye
- F. Grain sorghum
- G. Cotton
- H. Tobacco
- I. Rice
- J. Sugar crops
- K. Alfalfa
- L. Soybeans
- M. Peanuts

V. Classes of Plants

- A. Cereals
  - 1. Barley
  - 2. Wheat
  - 3. Corn
  - 4. Oats
  - 5. Rice
- B. Root crops
  - 1. Potatoes
  - 2. Sugar beets
- C. Tree crops
  - 1. Prunes and plums
  - 2. Apples
  - 3. Sweet cherries
- D. Pulses
  - 1. Peas
  - 2. Lentils
  - 3. Beans

6. Land Ownership

    a. Private lands 31%

    b. County and municipal .2%

    c. State lands 4.8%

    d. Federal 64%

    (Note: Compare county statistics with state statistics.)

VII. How much crop can be produced per acre?

A. Average yields for Idaho include:

1.	Barley	59 bu/acre
2.	Corn for grain	110 bu/acre
3.	Dry beans, combined	17.6 cwt/acre
4.	Alfalfa hay	3.5 ton/acre
5.	Lentils	9.4 cwt/acre
6.	Potatoes	246 cwt/acre
7.	Sugarbeets	26 ton/acre
8.	Wheat	59.5 bu/acre

B. Record yields recorded

1.	Potatoes	1,000 cwt/acre
2.	Dry land wheat	208 bu/acre

VIII. Factors that affect amount of crop produced

A. Crop being raised

(Note: This is dictated by area and will be related to the presence of absence of other factors such as length of growing season, soil type, pests, etc.)

B. Climate

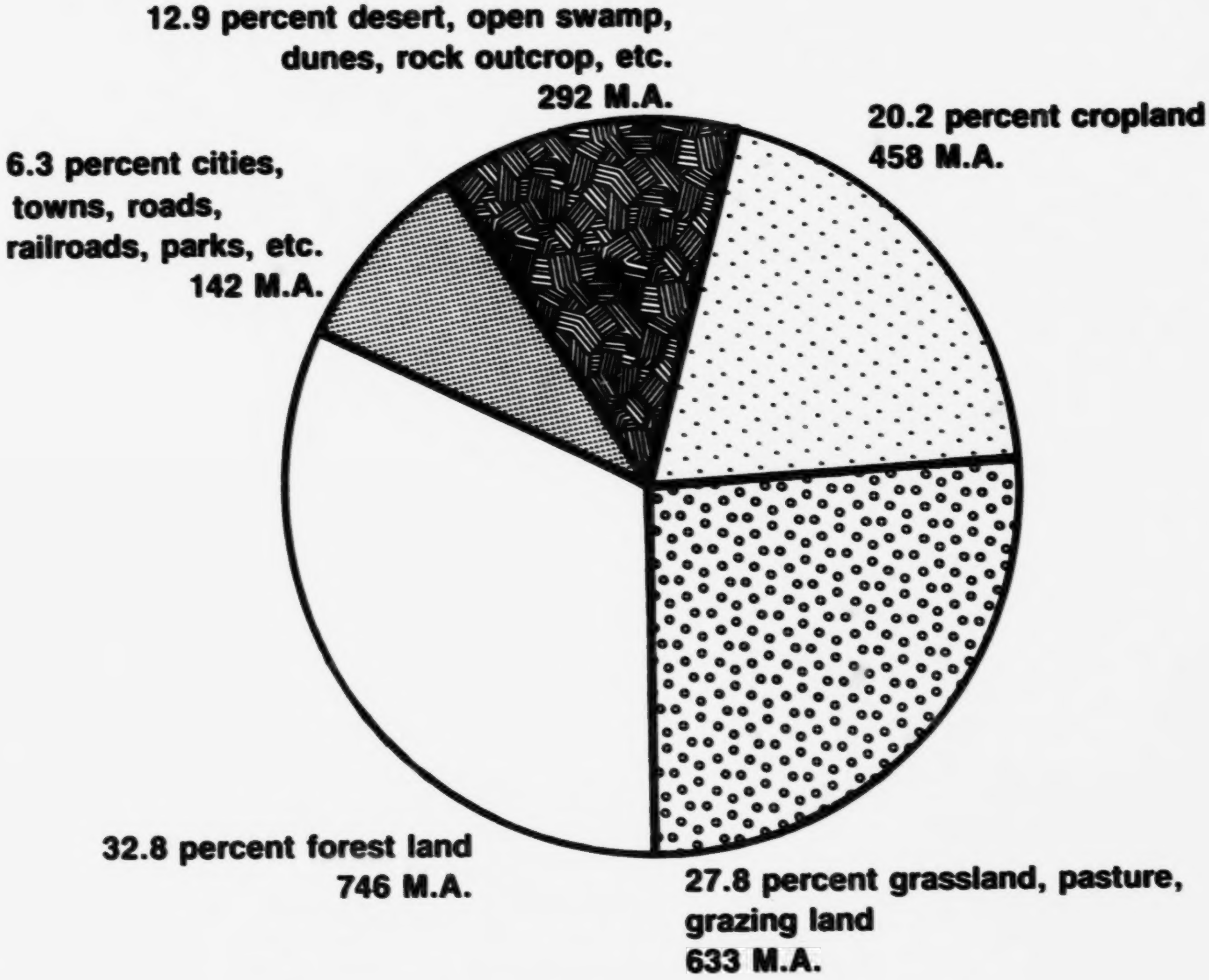
1. Annual precipitation
2. Temperature

Good Things We Get From Plants

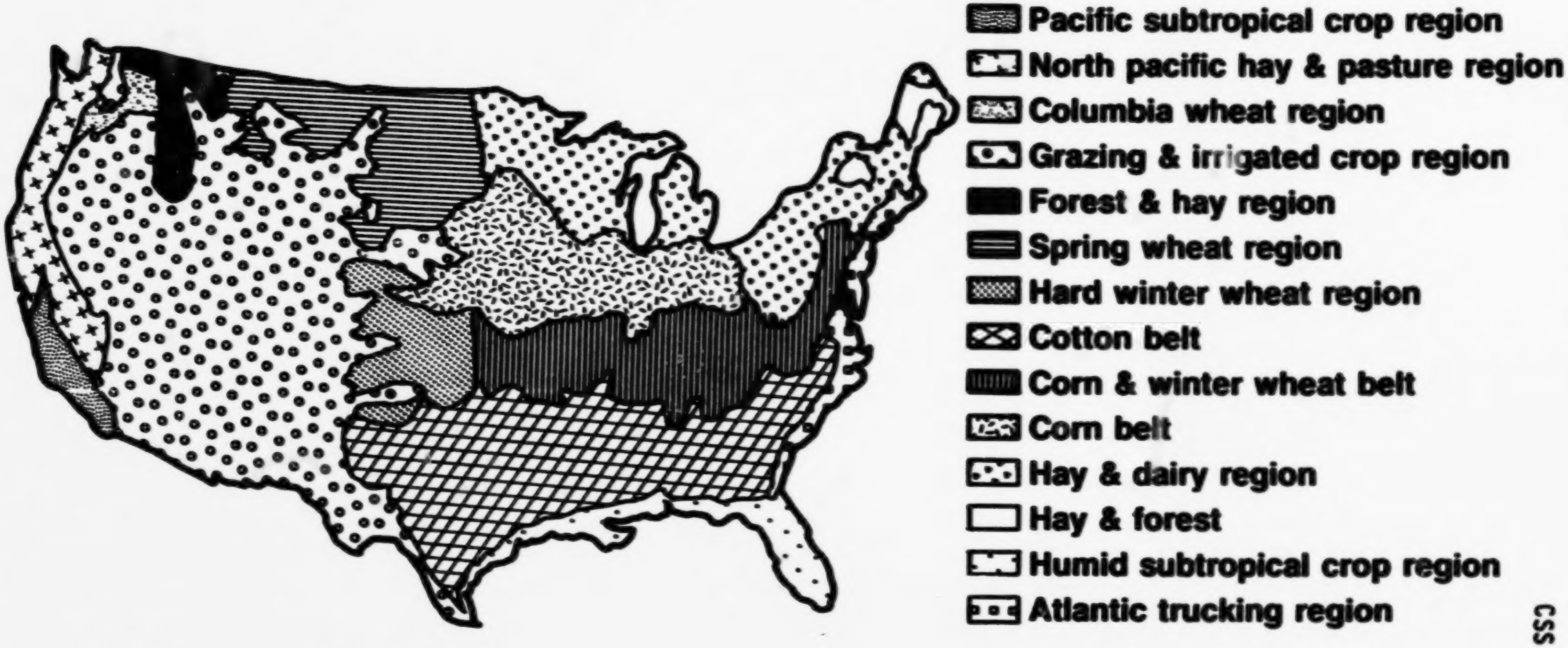
1. Oxygen for man and animal to breath
2. Fuel for heating and transportation
3. Building materials
4. Medicines and drugs
5. Food for man and animal nutrition
6. Fabric for clothing and other purposes
7. Paper
8. Cover against wind and water
9. Habitat for animals

Major Uses of Land

Total U.S. Acreage
2,271 Million Acres (50 States)



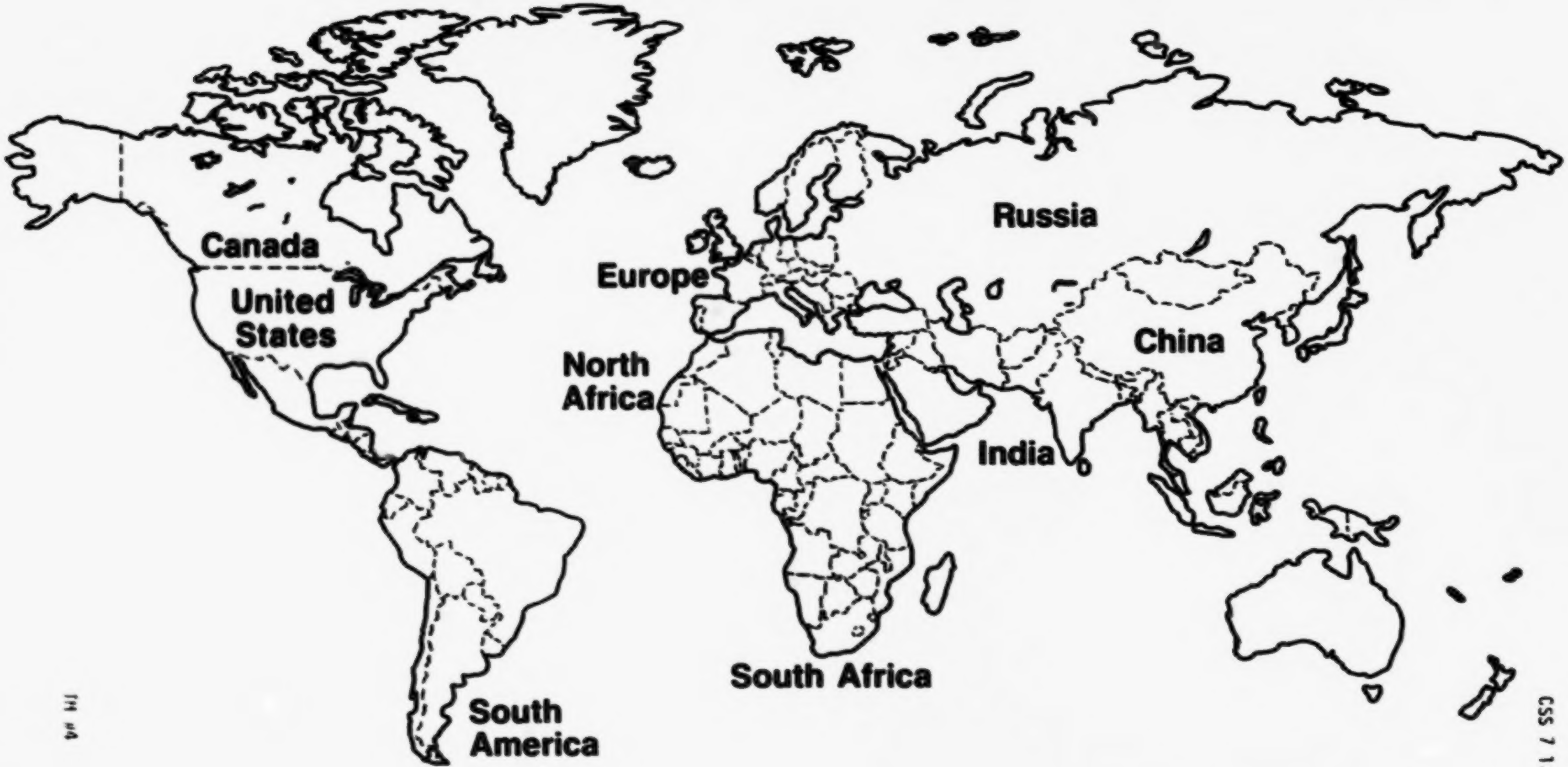
Major Crop Areas
United States


Pacific subtropical crop region
North pacific hay & pasture region
Columbia wheat region
Grazing & irrigated crop region
Forest & hay region
Spring wheat region
Hard winter wheat region
Cotton belt
Corn & winter wheat belt
Corn belt
Hay & dairy region
Hay & forest
Humid subtropical crop region
Atlantic trucking region

TM #3

CSS 7 12

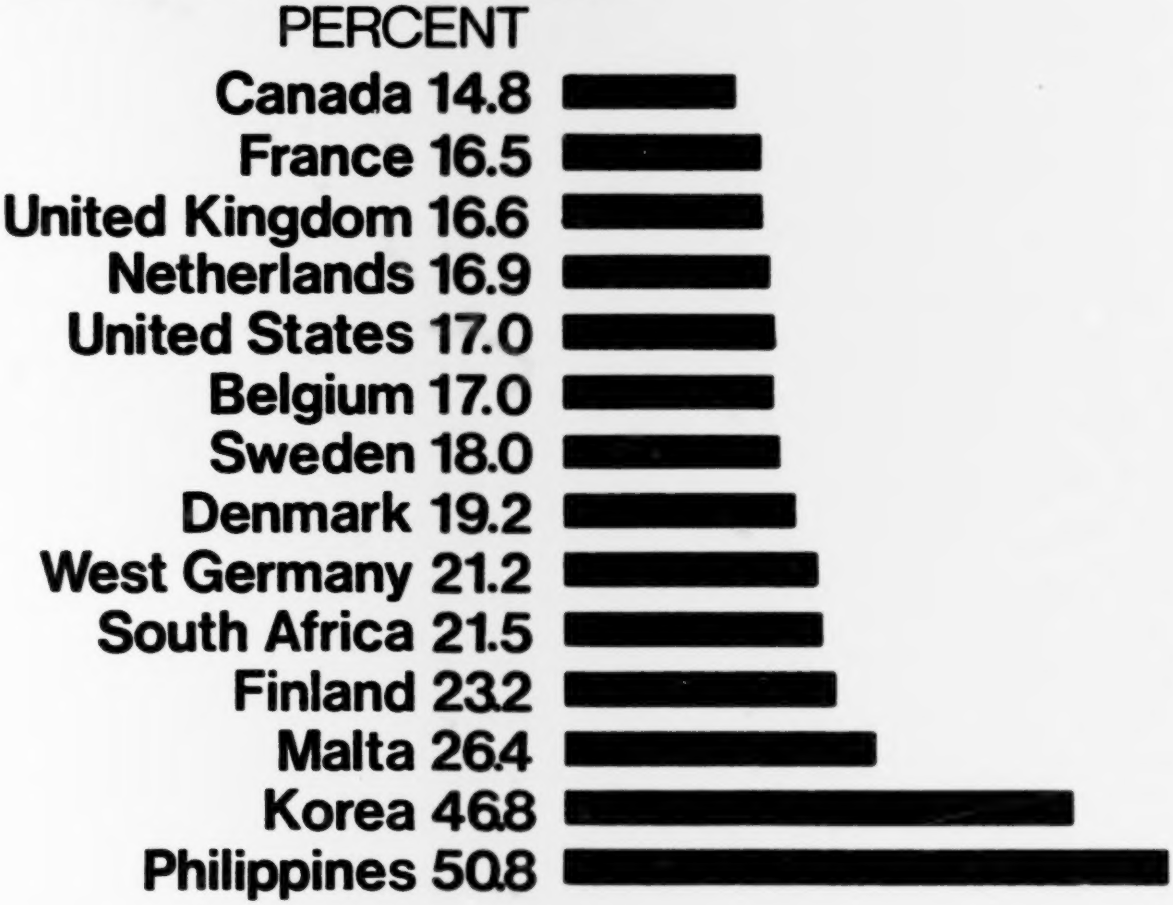
Major Crop Areas - World


Canada
United States
Europe
North Africa
South America
South Africa
Russia
China
India

TM #4

CSS 7 13

SHARE OF AFTER TAX INCOME SPENT ON FOOD



INTRODUCTION TO CROP SCIENCE
UNIT 7

TEST

NAME____ SCORE________________

1. Match terms associated with crop science to the correct definitions. Write the correct numbers in the blanks.

1. Agronomy
2. Arable land
3. Arid climate
4. Cereal
5. Forage
6. Legume
7. Pulse
8. Range
9. Weed
10. Native plant
11. Introduced plant
12. Cwt
13. Bushel
14. Ton

_____a. Extensive area of natural pasture land

_____b. 100 pounds

_____c. Grass grown to be used for feed or seed

_____d. Plant originating in North America

_____e. Undesirable plant growing with a crop

_____f. Livestock feed, such as pasture, hay, or silage

_____g. Land which is capable in its present condition of producing crops requiring tillage

_____h. Soil improving plant which manufactures nitrogen

_____i. Science of crop production and soil management

_____j. Plant brought in from countries outside the United States

_____k. Thirty-two dry quarts; a common measurement for small grains

_____l. Leguminous plants or their seeds; this included chiefly those plants with large seed used for food

_____m. 2000 pounds; a common measurement for forage, sugarbeets, and sweet corn

_____n. Climate in which the annual rainfall is less than 10 inches

TEST

5. Classify the following plants as a cereal (C), root crop (R), tree crop (T), pulse (P), oil seed (O), or forage crop (F). Write the correct letters in the blanks.

_____a. Potatoes

_____b. Soybeans

_____c. Wheat

_____d. Field corn

_____e. Lentils

_____f. Sweet cherries

_____g. Alfalfa hay

_____h. Oats

_____i. Beans

_____j. Cotton seed

6. Match the category of land use in the U.S. with the correct percentage. Write the correct numbers in the blanks.

1. 32.8%
2. 27.8%
3. 20.2%
4. 12.9%
5. 6.3%

_____a. Cities, roads, railroads, parks, etc.

_____b. Desert, swamp, rock, etc.

_____c. Cropland

_____d. Grassland, pasture, grazing land

_____e. Forest land

INTRODUCTION TO CROP SCIENCE
UNIT 7

ANSWERS TO TEST

1.

a.	8	e.	9	i.	1	m.	14
b.	12	f.	5	j.	11	n.	3
c.	4	g.	2	k.	13		
d.	10	h.	6	l.	7		

2. a, b, c, d, e, f, g

3. a, b, c, d, g, h

4. Answer should include any five of the following

   a. Corn
   b. Wheat
   c. Oats
   d. Barley
   e. Rye
   f. Grain sorghum
   g. Cotton
   h. Tobacco
   i. Rice
   j. Sugar crops
   k. Alfalfa
   l. Soybeans
   m. Peanuts

5.

a.	R	f.	T
b.	O	g.	F
c.	C	h.	C
d.	F	i.	P
e.	P	j.	O

6.

a.	5	d.	2
b.	4	e.	1
c.	3		

7.

a.	6	e.	8
b.	5	f.	7
c.	2	g.	3
d.	1	h.	4

8. Answer should include any four of the following

   a. Crop being raised
   b. Climate
   c. Pests
   d. Soil features
   e. Economics

BASIC PLANT PROCESSES
UNIT 8

UNIT OBJECTIVE

After completing this unit the student should be able to list the important plant processes. The student should be able to illustrate the process of photosynthesis and select from a list factors that effect photosynthetic rate. They should be able to illustrate the process of respiration, and identify processes as being characteristic of respiration or photosynthesis. The student should be able to briefly explain the processes of absorption and transpiration. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with basic plant processes to the correct definition.
2. Name the four important plant processes in food manufacture and growth.
3. Select from a list reasons photosynthesis is the most important process in the world.
4. Explain the process of photosynthesis.
5. Select from a list factors that effect photosynthetic rate.
6. Explain the process of respiration.
7. Classify characteristics as that of photosynthesis or respiration.
8. Match ways nutrients and water are absorbed by the plant to the correct definition.
9. Explain the process of absorption by plant roots.
10. Explain the process of transpiration.
11. Select from a list factors affecting water loss by transpiration.

BASIC PLANT PROCESSES
UNIT 8

SUGGESTED ACTIVITIES

I. Suggested activities

- A. Order materials to supplement unit
    - 1. Literature

    - 2. Filmstrips, slideshows, etc.

    - 3. Films

- B. Make transparencies
- C. Provide students with objective sheet
- D. Provide students with information, assignment and job sheets
- E. Discuss unit and specific objectives
- F. Discuss information and assignment sheets
- G. Demonstrate and discuss procedures outlined in job sheets
- H. Give test
- I. Reteach if necessary
- J. Retest

SUGGESTED ACTIVITIES

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Important plant processes

2. TM 2--Importance of photosynthesis

3. TM 3--Photosynthesis

4. TM 4--Photosynthesis and respiration in relation to dry weight

5. TM 5--Transpiration

6. TM 6--Root hairs, soil particles, and moisture

7. TM 7--How a water solution from the soil moves within a root

D. Assignment sheets

1. AS 1--Light in relation to increase in dry weight

E. Job sheets

1. JS 1--Measuring loss from transpiration

III. Unit references

A. Delorit, R.J., et al. Crop Production, 4th edition Englewood Cliffs, New Jersey. Prentice-Hall, Inc.

B. Janick, J. et al. Plant Science, 2nd edition. San Francisco, CA. W.H. Freeman and Co.: 1974.

C. Hudson, H.T., et al. Plant Science - Growth, Development, and Utilization of Cultivated Plants. Englewood Cliffs, New Jersey. Prentice-Hall, Inc.: 1981.

D. Raven, P.H., et al. Biology of Plants, 3rd edition. New York, N.Y. Worth Publishers, Inc.: 1981.

E. Fridline, C.R. Plant Growth and Development. Columbus, OH. Ohio State University. Ohio Agricultural Education Curriculum Materials Service: 1980.

BASIC PLANT PROCESSES
UNIT 8

INFORMATION SHEET

I. Terms and definitions

A. Photosynthesis--The process of making sugars in green plants from water and carbon dioxide in the presence of sunlight

B. Respiration--The process of using the stored foods of a plant in which energy is obtained or released

C. Transpiration--The evaporation of water vapor from the stoma on the leaves of a plant

D. Absorption--The taking in of water and mineral nutrients through the roots of a plant

E. Stoma--A small opening in the epidermis of leaves and stems through which gases pass

F. Mesophyll--The photosynthetic tissue of a leaf, located between the layers of epidermis

G. Chlorophyll--The green pigment of plant cells; necessary for photosynthesis

H. Chloroplast--A cellular organelle in which chlorophyll is contained; site of photosynthesis

I. Phloem--Food conducting tissue of plants

J. Root hairs--Outgrowths of the epidermal cells of the root; greatly increase absorption area of the root system

K. Permeable membrane--A membrane through which liquid substances may diffuse, such as the plasma membrane of root hair cells

L. Epidermis--The outermost layer of cells of the leaf and of young stems and roots

M. Cortex--Cells of a stem or root bounded externally by the epidermis and internally by the vascular system

N. Xylem--Tissue through which most of the water and minerals of a plant are conducted

INFORMATION SHEET

II. Important plant processes in food manufacture and growth (Transparency #1)

A. Photosynthesis

B. Respiration

C. Transpiration

D. Absorption

III. Reasons photosynthesis is the most important process in world (Transparency #2)

A. Plants produce food by photosynthesis

B. Plants produce food used directly by man

C. Plants produce food used indirectly by man through meat and milk produced by livestock

(Note: Green plants, through the process of photosynthesis, are the basic factory of the world, on which all life is dependent. A corn plant produces about 5 grams of sugar during 14 hours of sunlight. During a 100-day period, a 20-acre field of corn with 20,000 plants per acre could produce two and one-half tons of sugar. An estimated 150 billion tons of sugars are produced by plants each year by photosynthesis. This would be a pile of sugar 40 miles square at the base and 2 miles high at the peak.)

IV. Process of photosynthesis (Transparency #3)

A. Carbon dioxide (CO_2) enters the leaf from the surrounding air through the stoma

(Note: After CO_2 enters the stoma, it enters the intercellular spaces of the mesophyll tissue. Here it comes in contact with the wet walls of the mesophyll cells. The CO_2 dissolves in the water of the mesophyll cells.)

B. Water moves from the soil into the root, stems and leaves through the xylem tissue

C. The molecules of water (H_2O) and carbon dioxide (CO_2) are synthesized (put together) in the chlorophyll of a plant with energy from sunlight

INFORMATION SHEET

D. The end result is the formation of sugar which is transported by the phloem tissue to the part of the plant where it is used

(Note: The process can be illustrated by the chemical equation which is written: 6 parts carbon dioxide (6 CO_2) + 6 parts water (6 H_2O) + 672 K. cal of radiant energy (sunlight) in the the presence of chlorophyll of plants = sugar ($C_6H_{12}O_6$) retained by the plant + oxygen (6 O_2) given off into the atmosphere.)

V. Factors that effect photosynthetic rate

A. Water supply

B. Temperature

C. Light quality

D. Light intensity

E. Deficiency of certain plant nutrients

VI. Process of respiration

(Note: As with all living things, plants require energy to carry out their growth and development process. This energy comes from a very complex process called respiration. In a sense, respiration in plants is the reverse of photosynthesis as sugar is broken down to produce energy.)

A. Sugar is broken down to produce energy for essential plant functions

B. Respiration consumes oxygen (O_2) and glucose ($C_6H_{12}O_6$)

C. Respiration gives off carbon dioxide (CO_2) and water (H_2O)

(Note: The process can be illustrated by the chemical equation which is written: Sugar ($C_6H_{12}O_6$) + 6 parts oxygen (6 O_2) = six parts carbon dioxide (6 CO_2) + 6 parts water (6 H_2O).)

VII. Relationship between photosynthesis and respiration (Transparency #4)

Photosynthesis	Respiration
1. A building process (+)	1. A destruction process (-)
2. Sugars manufactured	2. Sugars consumed
3. CO_2 is consumed	3. CO_2 is given off
4. Oxygen is given off	4. Oxygen is consumed
5. Requires light	5. Goes on day and night
6. Only takes place in cells containing chlorophyll	6. Carried on in all cells
7. Sugar ($C_6H_{12}O_6$) is the end product	7. Energy produced for plant functions is end product

(Note: A green plant grown in the dark loses in weight because its stored foods are respired and nothing is added through photosynthesis.)

VIII. Absorption of nutrients and water

A. Diffusion--Movement of gases or liquid from an area of high concentration to an area of low concentration

B. Osmosis--Movement of a substance from a place of greater concentration through a semi-permeable membrane to a place of lesser concentration

C. Non-root feeding (leaf feeding)--Nutrients and water entering the plant through leaves and stems

IX. The process of absorption

A. The soil solution enters the root hairs by the process of osmosis

(Note: The soil solution is composed of water and minerals in solution.)

B. After the soil solution is absorbed by the root hairs, it moves through the epidermal cells, cortex, and phloem to the xylem

C. The xylem conducts the solution to other parts of the plant

INFORMATION SHEET

X. The process of transpiration (Transparencies #5, #6, and #7)

A. Water enters plant through root hairs

B. Water passes to xylem and up the stem to the leaves

C. A small amount of water is used in photosynthesis

D. The remainder is lost by transpiration

(Note: Water loss occurs mainly through the stoma on the leaves. When stoma are open, water vapor which is low in carbon dioxide escapes from the leaf and is replaced by dry air higher in carbon dioxide.)

XI. Factors affecting water loss by transpiration

A. Climatic conditions

B. The number of stoma on the leaves

C. Availability of soil moisture to the plant

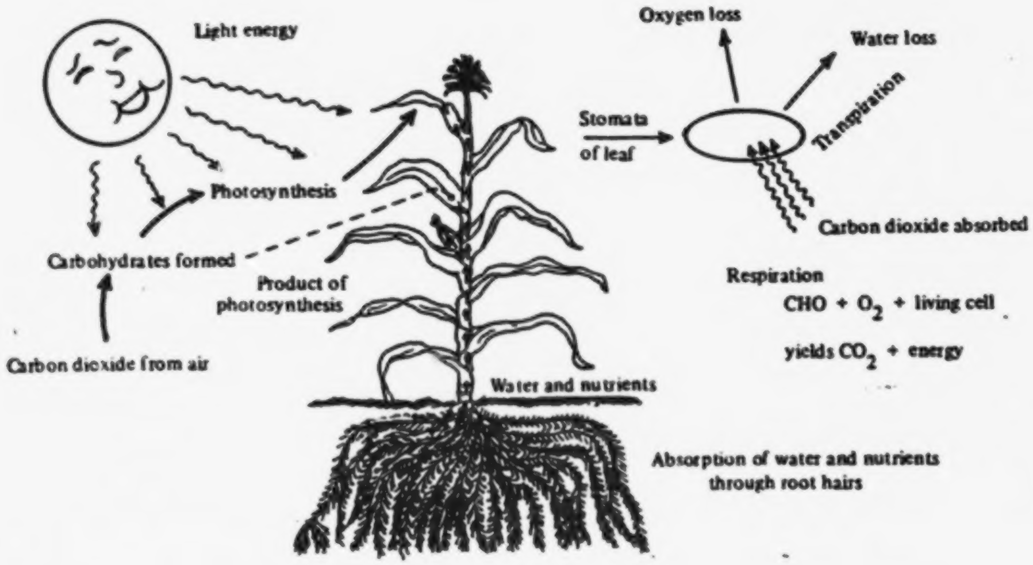
D. General plant structure

(Note: Some plants have a waxy covering called a cuticle which inhibits evaporation of water. Some plants have stoma only on lower side of leaf where temperatures are cooler.)

5. Soil fertility

(Note: Transpiration is greater for plants in fertile soils than poor soils; therefore the plant uses more water on fertile soils than poor soils.)

Important Plant Processes


Light energy
Photosynthesis
Carbohydrates formed
Carbon dioxide from air
Product of photosynthesis
Water and nutrients
Absorption of water and nutrients through root hairs
Oxygen loss
Water loss
Transpiration
Stomata of leaf
Carbon dioxide absorbed
Respiration
CHO + O_2 + living cell
yields CO_2 + energy

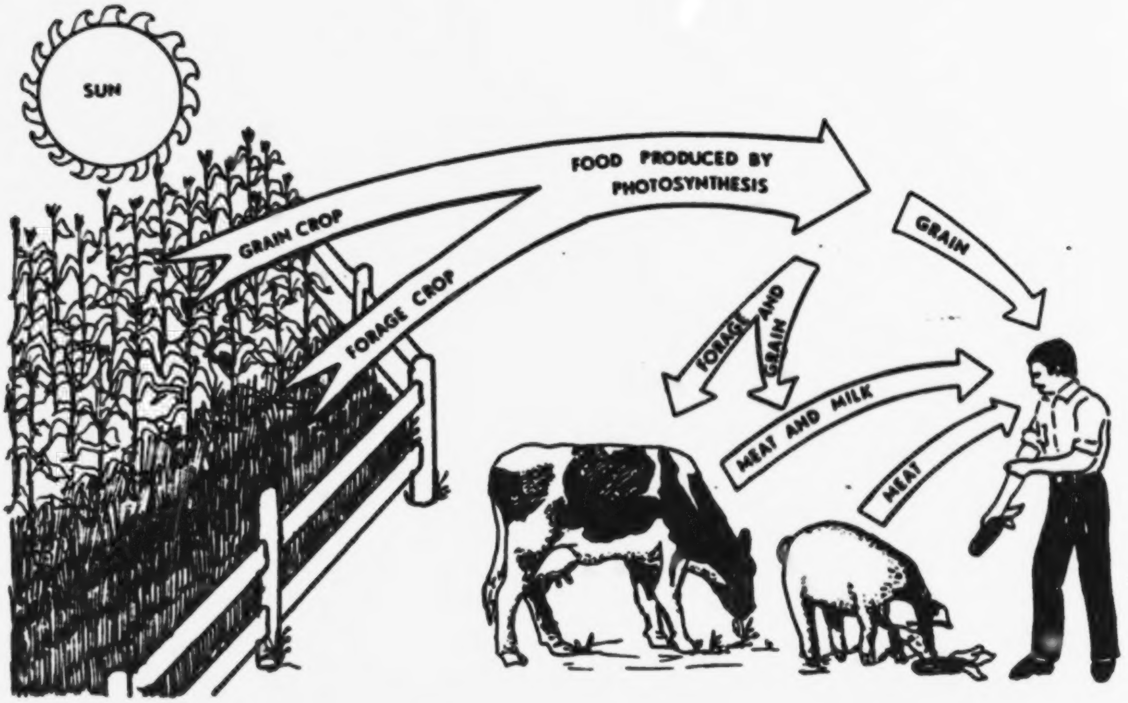
A series of events must take place for plant growth to occur. Important ones are:

- **Photosynthesis**
- **Respiration**
- **Transpiration**
- **Absorption**

TM #1

BEST COPY AVAILABLE

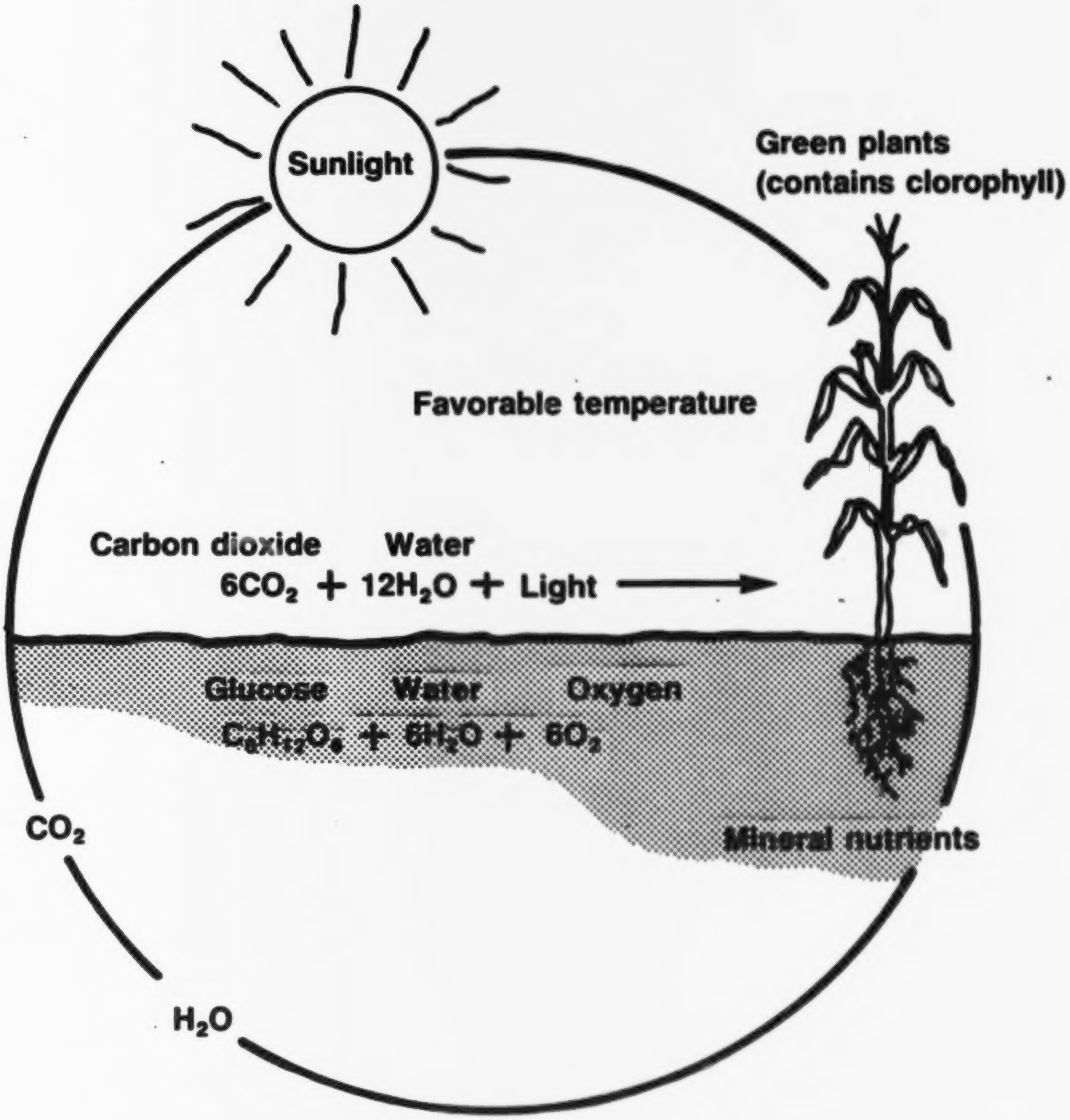
Importance of Photosynthesis


SUN
FOOD PRODUCED BY PHOTOSYNTHESIS
GRAIN CROP
FORAGE CROP
GRAIN
FORAGE AND GRAIN
MEAT AND MILK
MEAT

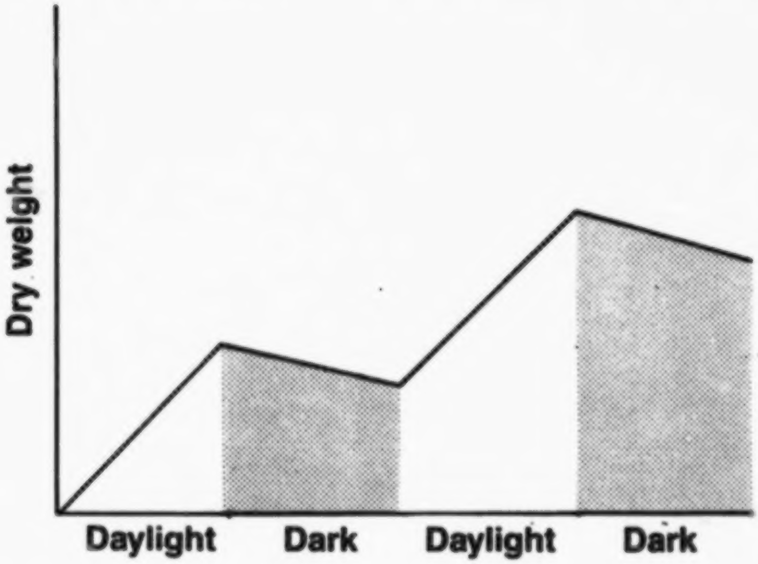
Through the process of photosynthesis, crop plants produce food. This plant-produced food is used directly by man or indirectly through meat and milk produced by livestock.

TM #2

Photosynthesis


Sunlight
Green plants
(contains clorophyll)
Favorable temperature
Carbon dioxide Water
$6CO_2 + 12H_2O +$ Light $\longrightarrow$
Glucose Water Oxygen
$C_6H_{12}O_6 + 6H_2O + 6O_2$
Mineral nutrients
CO_2
H_2O

Photosynthesis and Respiration in Relation to Dry Weight



Daylight hours

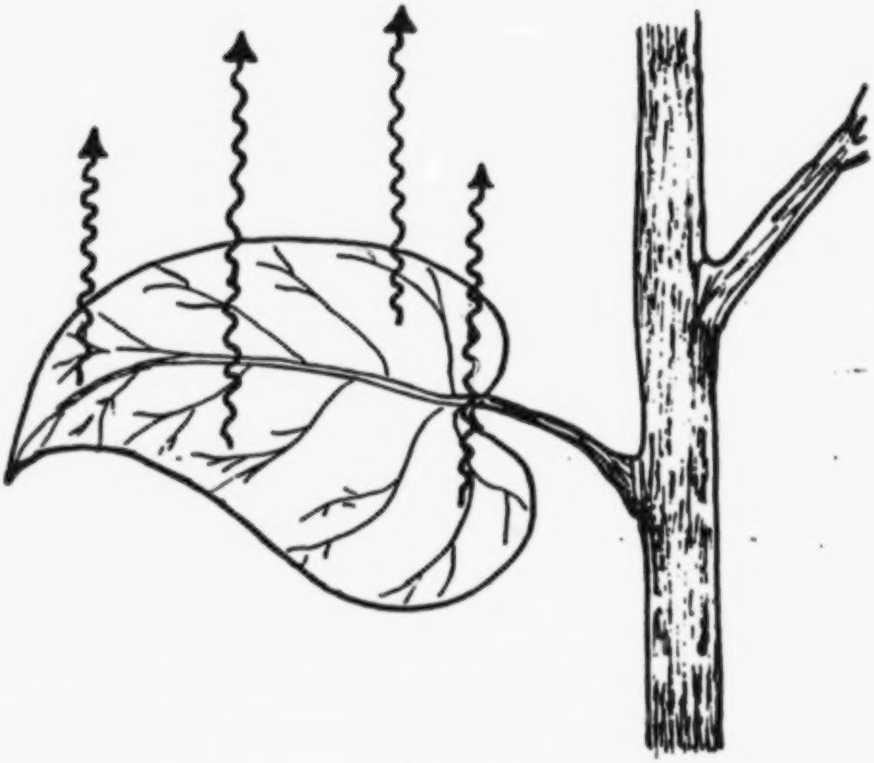
- The sugar produced by photosynthesis is greater than the sugar used by respiration.
- Result is increase in dry weight.

Dark hours

- No sugar is produced by photosynthesis.
- Sugar is used by respiration.
- Result is decrease in dry weight.

TM #4

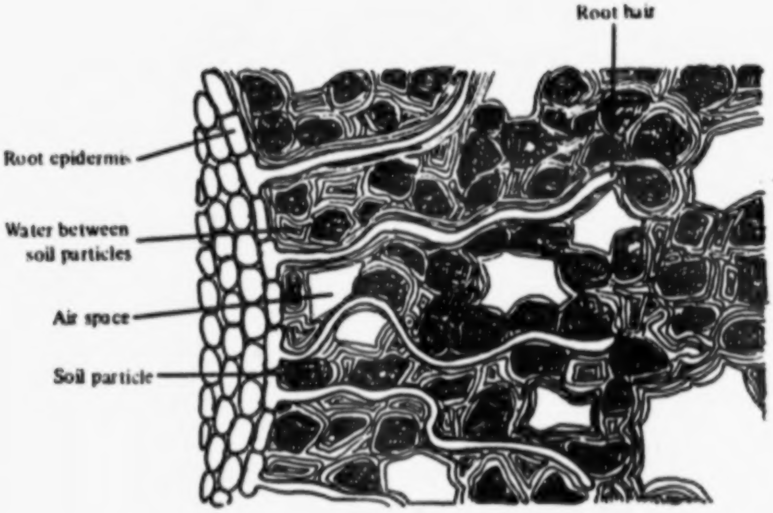
Transpiration



Is the loss of water from plants by evaporation

TM #5

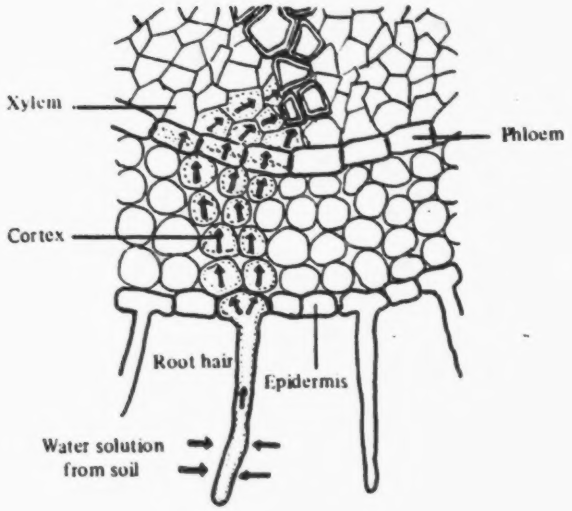
Root Hairs, Soil Particles and Moisture


Root hair
Root epidermis
Water between soil particles
Air space
Soil particle

1. **Root hairs increase the absorption area of the root system 3 to 5 times.**
2. **Water and minerals in solution enter the plant mainly through the root hairs.**

TM #6

How a Water Solution From the Soil Moves Within the Root


Xylem
Phloem
Cortex
Root hair
Epidermis
Water solution from soil

1. **Solution enters the root hair by osmosis.**
2. **Solution moves through the epidermal cells, the cortex and the *phloem* to the *xylem* tissue.**
3. **Solution is transported by the xylem to other parts of the plant.**

BASIC PLANT PROCESSES
UNIT 8

ASSIGNMENT SHEET #1--LIGHT RELATION TO INCREASE IN DRY WEIGHT

Name____ Score______________

PART I:

Three hundred bean seeds were divided into three lots of 100 each. One lot of 100 seeds was used to measure the percent moisture in the seeds, from which it was possible to calculate the dry weight of the other two lots. A second lot of seeds was sown in sand in a suitable box and kept in a dark room. The third lot was likewise sown in sand in a suitable box and kept under a daily cycle of 15 hours of light and 9 hours of dark. These two lots of seeds were kept at a temperature of 75°F. Four weeks after planting, each lot of resulting seedlings was harvested and the dry weight of each was measured. These resulting data are tabulated.

Environmental Condition	Calculated Dry Weight of Seeds Planted	Dry Weight of Seedlings at End of Four	Difference Between Dry Weight of Seedlings and Dry Weight of Seeds Planted
Seedlings in light	57.9 g	82.2 g	+24.3 g
Seedlings in dark	57.9 g	23.4 g	-34.5 g

PART II:

A. What one environment factor was varied in this experiment?

B. How do you account for the increase in dry weight of the seedlings in light as compared with the dry weight of the seeds which were planted in darkness?

ASSIGNMENT SHEET #1

C. Why do the seedlings that developed in the dark not gain in dry weight?

D. Why do the seedlings that developed in the dark actually decrease in dry weight?

E. Is light necessary for the utilization of food in the growth of plants?

BASIC PLANT PROCESSES
UNIT 8

ANSWERS TO ASSIGNMENT SHEETS

ASSIGNMENT SHEET #1

A. Light

B. Photosynthesis is greater than respiration

C. Respiration is greater than photosynthesis

D. Sugars are utilized by respiration for basic functions of the plant without being replenished by photosynthesis

E. Yes

BASIC PLANT PROCESSES
UNIT 8

JOB SHEET #1--MEASURING LOSS FROM TRANSPIRATION

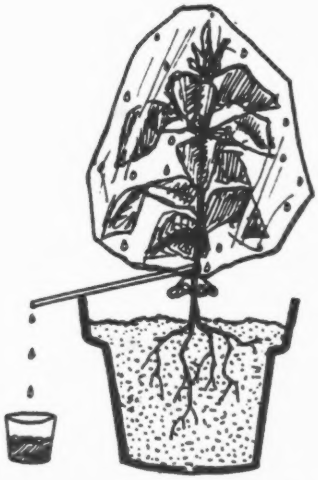
I. Materials needed

- A. A growing plant in a pot, bucket, or other container or a plant growing in a convenient location
- B. Plastic bag or sheet of clear plastic that will cover the plant or a branch of the plant containing 10 to 12 leaves
- C. String, rubber bands, or other suitable tie materials
- D. Stake to support the weight of the plastic
- E. Plastic straw or other suitable tubing for a drain
- F. Measuring cup or beaker

II. Procedure (Figure 1)

- A. Be sure plant has been watered
- B. Cover the entire vegetative portion of the plant or a section with plastic material
- C. Locate tubing at bottom of plastic covering to serve as a water drain
- D. Place plant in sunny location for an entire day; measure the water collected; empty container
- E. Measure water collected during dark period of the day
- F. Compare differences in the amount of water collected

Figure 1:



JOB SHEET #1

III. Questions

A. Which period produced the most water in the container?
Why?

B. Does temperature have an effect on transpiration rates?
Does light? Air humidity?

BASIC PLANT PROCESSES
UNIT 8

TEST

NAME____ SCORE________________

1. Match terms associated with basic plant processes to the correct definitions. Write the correct numbers in the blanks.

   1. Photosynthesis
   2. Respiration
   3. Transpiration
   4. Absorption
   5. Stoma
   6. Mesophyll
   7. Chlorophyll
   8. Chloroplast
   9. Phloem
   10. Root hairs
   11. Permeable membrane
   12. Epidermis
   13. Cortex
   14. Xylem

____a. A small opening in the epidermis of leaves and stems through which gases must pass

____b. The green pigment of plant cells; necessary for photosynthesis

____c. The process of making sugars in green plants from water and carbon dioxide in the presence of sunlight

____d. Food conducting tissue of plants

____e. The outermost layer of cells of the leaf and of young stems and roots

____f. The evaporation of water vapor from the stoma on the leaves of a plant

____g. A cellular organelle in which chlorophyll is contained; site of photosynthesis

____h. Tissue through which most of the water and minerals of a plant are conducted

____i. The photosynthetic tissue of a leaf; located between the layers of epidermis

____j. The process of using the stored foods of a plant in which energy is obtained or released

____k. A membrane through which liquid substances may diffuse, such as the plasma membrane of root hair cells

____l. The taking in of water and mineral nutrients through the roots of a plant

TEST

____m. Cells of a stem or root bounded externally by the epidermis and internally by the vascular system

____n. Outgrowths of the epidermal cells of the root; greatly increases absorption area of the root system

2. Name the four important plant processes in food manufacture and growth.

a.____________________

b.____________________

c.____________________

d.____________________

3. Select from the following list reasons photosynthesis is the most important process in the world. Write an "X" in the blank before each correct answer.

____a. Produces food used directly by man

____b. Releases carbon dioxide

____c. It warms the soil

____d. Produces food used indirectly by man

____e. All life is dependent on photosynthesis

____f. Releases moisture into the atmosphere

4. Explain the process of photosynthesis.

____

____

____

____

____

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____

TEST

5. Select from the following list factors that effect photosynthetic rate. Write an "X" in the blank before each correct answer.

____a. Nutrient deficiency

____b. Water supply

____c. Quality of light

____d. Amount of heat

____e. Intensity of light

6. Explain the process of respiration.

____

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____

7. Classify the following characteristics as that of photosynthesis (X) or respiration (O). Write the correct letter in the blank before each statement.

____a. Sugar is the end product

____b. Carbon dioxide is given off

____c. Requires light

____d. A destruction process

____e. Goes on day and night

____f. A building process

____g. Only takes place in cells containing chlorophyll

____h. Carried on in all cells

____i. Oxygen is given off

____j. Sugars consumed

TEST

8. Match ways nutrients and water are absorbed by the plant to the correct definition. Write the correct numbers in the blanks.

   1. Diffusion

   2. Osmosis

   3. Non-root feeding

   ____a. Nutrients and water entering the plant through leaves and stems

   ____b. Movement of gases or liquid from an area of high concentration to an area of low concentration

   ____c. Movement of a substance from a place of greater concentration through a semi-permeable membrane to a place of lesser concentration

9. Explain the process of absorption by plant roots.

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____

10. Explain the process of transpiration.

____

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____

TEST

11. Select from the following list factors affecting water loss by transpiration. Write an "X" in the blank before each correct answer.

____a. Amount of available water

____b. Number of root hairs

____c. Presence of cuticle on leaf

____d. Number of stoma on leaf

____e. Soil fertility

____f. Type of root structure

____g. Climatic conditions

____h. Amount of sunlight

BASIC PLANT PROCESSES
UNIT 8

ANSWERS TO TEST

1. a. 5
   b. 7
   c. 1
   d. 9
   e. 12
   f. 3
   g. 8
   h. 14
   i. 6
   j. 2
   k. 11
   l. 4
   m. 13
   n. 10

2. Answer should include the following:

   a. Photosynthesis

   b. Respiration

   c. Transpiration

   d. Absorption

3. a, d, e

4. Evaluated to satisfaction of instructor

5. a, b, c, d, e

6. Evaluated to satisfaction of instructor

7. a. X
   b. O
   c. X
   d. O
   e. O
   f. X
   g. X
   h. O
   i. X
   j. O

8. a. 3 b. 1 c. 2

9. Evaluated to satisfaction of instructor

10. Evaluated to satisfaction of instructor

11. a, c, d, e, g

PLANT GROWTH AND DEVELOPMENT
UNIT 9

UNIT OBJECTIVE

After completing this unit, the student should be able to match terms and definitions and identify the parts of a plant. The student should also be able to match functions and plant parts. The student should also be able to select from a list requirements for good seed germination, and list factors that cause poor germination. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with plant growth and development to the correct definitions.
2. Name the three stages of plant growth and development.
3. Name three requirements for good seed germination.
4. Label a drawing showing the parts of a monocot and dicot seed.
5. Arrange in order the stages of germination for a monocot and dicot.
6. Select from a list factors that cause poor seed germination.
7. Label a drawing showing the four primary parts of a plant.
8. Match functions of plant parts to the correct part.
9. Name two types of root systems.
10. Label a drawing showing the parts of a stem.
11. Label a drawing showing the plant tissues in a monocot and dicot stem.
12. Match stem modifications with the correct description.
13. Select from a list conditions affecting the vegetative growth of crop plants.
14. Name the three vegetative growth stages of small grains.
15. Name the four vegetative growth stages of corn.

OBJECTIVE SHEET

16. Name two means of reproduction by plants.
17. Arrange in order the life cycle of a flowering plant.
18. Label a drawing showing the parts of a complete flower.
19. Match the type of flower to the correct description.
20. Match the types of pollination to the correct description.
21. Name three ways pollen is moved.
22. Explain the process of fertilization in plants.

PLANT GROWTH AND DEVELOPMENT
UNIT 9

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit

      1. Literature

         a. Agronomy Curriculum Materials Packet, 232 pages; available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $10.00, order no. 214.

         b. Crop Production, 15 transparency masters; available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $2.25, order no. 517.

      2. Filmstrips, slideshows, etc.

         a. Agronomy, computer program; available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $15.00, order no. 902.

      3. Films

   B. Make transparencies

   C. Provide students with objective sheet

   D. Provide students with information sheet

   E. Discuss unit and specific objectives

   F. Discuss information sheet

   G. Give test

   H. Reteach if necessary

   I. Retest

SUGGESTED ACTIVITIES

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Transparency masters
    1. TM 1--A corn grain and its parts
    2. TM 2--A bean seed and its parts
    3. TM 3--Stages in germination and emergence of corn
    4. TM 4--Stages in germination and emergence of a bean seed
    5. TM 5--Primary parts of a plant
    6. TM 6--Functions of leaves, stems, roots, and flowers
    7. TM 7--Tap and fibrous roots
    8. TM 8--Parts of the stem
    9. TM 9--Arrangement of tissue in stems
    10. TM 10--Above ground stem modifications
    11. TM 11--Below ground stem modifications
    12. TM 12--Conditions affecting the vegetative growth of crop plants
    13. TM 13--Comparison of utilization of sunlight by crop plants
    14. TM 14--Plant growth variance with temperature change
    15. TM 15--Rate of photosynthesis and respiration as affected by temperature
    16. TM 16--Approximate pounds of water required to produce one pound of dry matter
    17. TM 17--Vegetative growth stages of wheat
    18. TM 18--Vegetative growth stages of corn
    19. TM 19--The life cycle of a flowering plant

SUGGESTED ACTIVITIES

20. TM 20--Parts of a complete flower

21. TM 21--Self-pollination and cross-pollination

E. Test

F. Answers to test

III. Unit references

A. Delorit, R.J., et al. Crop Production, 4th edition Englewood Cliffs, New Jersey. Prentice-Hall, Inc.

B. Janick, J. et al. Plant Science, 2nd edition. San Francisco, CA. W.H. Freeman and Co.: 1974.

C. Hudson, H.T., et al. Plant Science - Growth, Development, and Utilization of Cultivated Plants. Englewood Cliffs, New Jersey. Prentice-Hall, Inc.: 1981.

D. Raven, P.H., et al. Biology of Plants, 3rd edition. New York, N.Y. Worth Publishers, Inc.: 1981.

E. Fridline, C.R. Plant Growth and Development. Columbus, OH. Ohio State University. Ohio Agricultural Education Curriculum Materials Service: 1980.

F. Fridline, C.R. Seed Production of Corn, Small Grains and Soybeans. Columbus, OH. Ohio Agricultural Education Curriculum Materials Service: 1977.

PLANT GROWTH AND DEVELOPMENT
UNIT 9

INFORMATION SHEET

I. Terms and definitions

A. Node--The part of a stem where a leaf is attached

B. Internode--The part of stem between two nodes

C. Bud--An embryonic shoot of a plant

D. Leaf scar--A scar left on the stem when a leaf falls

E. Vascular bundle scar--A spot within a leaf scar left by the vascular bundles when a leaf falls

F. Monocot--Plant having one seed leaf (cotyledon) as in cereals and corn

G. Dicot--Plant having two seed leaves (cotyledons) as in beans and peas

H. Vascular bundle--A strand of tissue containing xylem and phloem enclosed by a sheath of cells

I. Xylem--Vascular tissue that transports water and minerals from the root system to the leaves

J. Phloem--Vascular tissue that conducts food from the leaves to regions of growth or storage

K. Pistil--Seed bearing organ of a flower, composed of the ovary, style and stigma

L. Stamen--Part of the flower producing the pollen; composed of the filament and anther

M. Fertilization--Union of the male (pollen) nucleus with the female (egg) cell

N. Pollination--Transfer of pollen from the anther to the stigma

O. Embryo--The young plantlet within the seed; the germ

P. Radicle--The embryonic root

Q. Hypocotyl--The part of an embryo between the cotyledons and the radicle

R. Epicotyl--The part of the embryo above the cotyledons and below the next leaves

INFORMATION SHEET

II. Stages of plant growth and development

A. Seed germination and seedling growth

B. Vegetative

C. Reproduction

III. Requirements for good seed germination

A. Proper temperature

(Note: This requirement varies for different crops. Cereals will show some germination at 32° F, while corn will not show any germination until 48° F.)

B. Sufficient moisture

(Note: This requirement varies for different crops. Cereals will germinate when their moisture content is about 50%. Soybeans will not germinate until their moisture content is about 75%. The range is 26% to 75% for most agronomic crops.)

C. Ample supply of oxygen

(Note: Germination will not occur if oxygen is not available for crops like small grains and peas. Rice seed can germinate in the absence of oxygen.)

IV. Parts of the seed

A. Monocot (Transparency #1)

1. Epicotyl
2. Hypocotyl
3. Radicle
4. Cotyledon
5. Coleoptile
6. Endosperm
7. Seed coat

INFORMATION SHEET

B. Dicot (Transparency #2)

1. Epicotyl
2. Hypocotyl
3. Radicle
4. Cotyledons
5. Seed coat

V. Stages of germination

A. Monocot (corn, small grains) (Transparency #3)

1. Absorption of water and oxygen into the seed

2. The seed coat ruptures and the primary root (radicle) begins to grow downward

3. The epicotyl elongates, the coleoptile piercing the soil as it grows upward

   (Note: The leaves of the coleoptile are rolled into tight pointed buds.)

4. The coleoptile emerges

   (Note: When the coleoptile emerges, the first node on the stem is still underground. It is from this node that the secondary root system develops.)

5. The coeloptile unfolds

   (Note: When the leaves of a seedling emerge above the soil surface and unfold, the plant is then capable of manufacturing its own food.)

B. Dicot (beans, peas) (Transparency #4)

1. Absorption of water and oxygen into the seed

2. The seed coat ruptures and the primary root (radicle) begins to grow downward

3. The hypocotyl curves into a loop and pushes through the soil, pulling the cotyledons toward the soil surface

4. Emergence of seedling occurs

(Note: The curve in the hypocotyl straightens out immediately after emergence so the plant will stand correctly.)

5. The cotyledons spread apart and the stem tip is exposed to air and sunlight

(Note: When the first pair of leaves has emerged, the plant is then capable of manufacturing its own food.)

VI. Factors that cause poor seed germination

A. Mechanical injury to seed (cracked grain)

B. Disease

C. Storage conditions

(Note: Temperature and humidity are important considerations for storage of crop seeds.)

D. Age of seed

(Note: Germination percentages will decrease as the age of the seed increases.)

E. Soil temperature too cold

F. Hard seed coat

(Note: Some plants (hard-seeded legumes) produce seeds with a hard seed coat. The seed coat will not allow moisture and oxygen to enter the seed and bring about germination.)

G. Soil moisture insufficient

H. Planting too deep

I. Chemical damage

(Note: Reduced germination percentages may result if seeds come in contact with chemicals such as fertilizers.)

J. Crusting of soil

VII. Primary parts of a plant (Transparency #5)

A. Roots

B. Stem

C. Leaves

D. Flowers

INFORMATION SHEET

VIII. Functions of plant parts (Transparency #6)

A. Roots

1. Absorb water and nutrients

(Note: Most of absorption takes place through root hairs. The rate at which water is absorbed depends on: (1) the rate at which water is lost from leaves (transpiration), (2) the amount of water in the soil, and (3) the amount of root surface in contact with soil particles.)

2. Anchors and supports plants

(Note: The root must anchor the plant to the extent that wind, etc. cannot knock it down.)

3. Storage of food

(Note: Some plants store foods they have manufactured in the roots. Examples are radishes, carrots, sweet potatoes and sugar beets.)

B. Stems

1. Supports leaves, flowers, fruit and seeds

2. Conducts water, nutrients and food

(Note: The stem conducts water and minerals in solution from the root system through the xylem tissue to the leaves. It also conducts food made in the leaves through the phloem tissue to the parts of the plant where it is growing or food is being stored.)

3. Storage of food

(Note: Examples of plants that store food in the stem include potatoes and asparagus.)

C. Leaves

1. Manufactures food for the plant

(Note: Photosynthesis is the process by which leaves make food from carbon dioxide and water in the presence of sunlight.)

2. Necessary for transpiration

INFORMATION SHEET

   3. Storage of food

      (Note: Examples of plants that store food in the leaves include lettuce, cabbage, celery, rhubarb, and onions.)

D. Flowers

   1. Serve as site of reproduction

   2. Storage of food

      (Note: Examples of plants that store food in flowers include grains, fruits, nuts, berries, broccoli and cauliflower.)

IX. Types of root systems (Transparency #7)

A. Tap root system

   (Note: In this system, one root is larger than the rest. Examples of plants with tap root systems include alfalfa, sugar beets, beans, carrots and radishes.)

B. Fibrous root system

   (Note: In this system, all roots are approximately the same size. Examples of plants with fibrous root systems include all the grasses and cereal grains.)

X. Parts of the stem (Transparency #8)

A. Node

B. Internode

C. Terminal bud

D. Lateral bud

E. Leaf scar

F. Vascular bundle scar

XI. Tissues in a stem (Transparency #9)

A. Monocots

   (Note: Vascular tissue, which consists of the xylem and phloem, is evenly distributed throughout the pith. With some monocots, the stem is hollow. Examples include wheat and oats.)

INFORMATION SHEET

1. Epidermis
2. Pith
3. Vascular bundles

B. Dicots

(Note: Vascular tissue forms in a single ring near the outside of the stem)

1. Epidermis
2. Cortex
3. Vascular bundles
4. Pith

XII. Stem modifications (Transparency #10)

A. Above ground

1. Crown--Appear just above or just below ground level from which modified stems grow. This type of growth is common in small grains
2. Stolon--Runners that grow along top of soil surface. This type of growth is common on strawberry plants and clover
3. Spur--Modified stem growth that appears laterally on branches of fruit trees and bears fruit

B. Below ground (Transparency #11)

1. Rhizome--Underground stems that grow horizontally below soil surface. This type of growth is common to bluegrass, bromegrass, quackgrass and canada thistle
2. Tuber--Enlarged fleshy parts found at the tip of a rhizome. This type of growth is common to potatoes
3. Corm--Fleshy, short underground stems with very few buds. This type of growth is common to timothy and gladiolus
4. Bulbs--Short disc-shaped stem surrounded by leaf-like scale structures. This type of growth is common to onion and garlic

INFORMATION SHEET

XIII. Conditions affecting the vegetative growth of crop plants (Transparency #13)

A. Climate

1. Sunlight

(Note: Sunlight is the energy source for photosynthesis. More efficient use of sunlight by a crop plant will result in higher yields, if other factors are not limiting.)

2. Temperature (Transparencies #14 and #15)

(Note: The temperature of both air and soil affects the rates at which the different plant processes take place. Air temperature affects the rate of photosynthesis, respiration, and transpiration. Soil temperature has an effect on respiration and absorption by the roots.)

3. Water (Transparency #16)

(Note: Water can be a severe limiting factor in the growth of crop plants. The availability of water, either by precipitation or irrigation, influences crop yield more than any other factor. Water is a requirement for food manufacture, a solvent for mineral nutrients, and a part of the transpiration process.)

B. Soil features

1. Nutrient availability

2. Moisture storage

3. Soil compaction

a. reduced water infiltration

b reduced root penetration

4. Amount of erosion

C. Crop pests

1. Disease

2. Insects

3. Weeds

INFORMATION SHEET

D. Crop being produced

E. Economics

(Note: Economics is the lease controllable of all variables affecting crop production. In many cases the point of maximum yield is not the same as maximum profit point. Crops should be managed to reach the point of maximum profit.)

XIV. Vegetative growth stages of small grains (Transparency #17)

A. Tillering

B. Jointing

C. Boot

XV. Vegetative growth stages of corn (Transparency #18)

A. Two-leaf stage

B. Six-leaf stage

C. Ten-leaf stage

D. Fourteen-leaf stage

XVI. Means of reproduction

A. Asexual

B. Sexual

(Note: The end result of sexual reproduction in plants is the seed. Seeds are of importance in production of a new crop and as food for both people and livestock.)

XVII. The life cycle of a flowering plant (Transparency #19)

A. Seed germination and seedling growth

B. Vegetative growth

C. Flower formation

D. Pollination

E. Fertilization

F. Seed development

INFORMATION SHEET

XVIII. Parts of a complete flower (Transparency #20)

A. Pistil--Female part where egg cell originates

1. Stigma--Upper part of pistil that catches pollen

2. Style--Supports stigma

3. Ovary--Produces ovules which develop into seeds

B. Stamen--Male part of flower

1. Filament--Supports anther

2. Anther--Bears the pollen

C. Accessory organs

1. Corolla--Petals of the flower

2. Calyx--Sepals of the flower

3. Pedicel--Stalk of an individual flower

XIX. Types of flowers

A. Complete--Has stamens, pistils, petals and sepals on same flower; common to dicots

B. Incomplete--Has stamens and pistils, but no petals or sepals; common to monocots

C. Perfect flower--Has both stamens and pistils on the same flower

D. Imperfect flower--Has either stamens or pistils, but not both on the same flower

E. Staminate--Has only male flower parts

F. Pistillate--Has only female flower parts

G. Monoecious--Staminate and pistillate flowers found on the same plant

(Examples: corn, cucumbers, squash, melons and pumpkins)

H. Dioecious--Staminate and pistillate flowers found on separate plants

(Examples: holly, date palm, spinach and asparagus)

INFORMATION SHEET

XX. Types of pollination (Transparency #21)

A. Self-pollination--Transfer of pollen from the anthers to the stigma of the same flower on the same plant

B. Cross-pollination--Transfer of pollen from the anthers of one plant to the stigmas of another plant

(Note: Cross-pollination usually requires an insect or bee transfer the pollen from one plant to the other.)

XXI. Pollen is moved by

A. Gravity

B. Wind

C. Insects

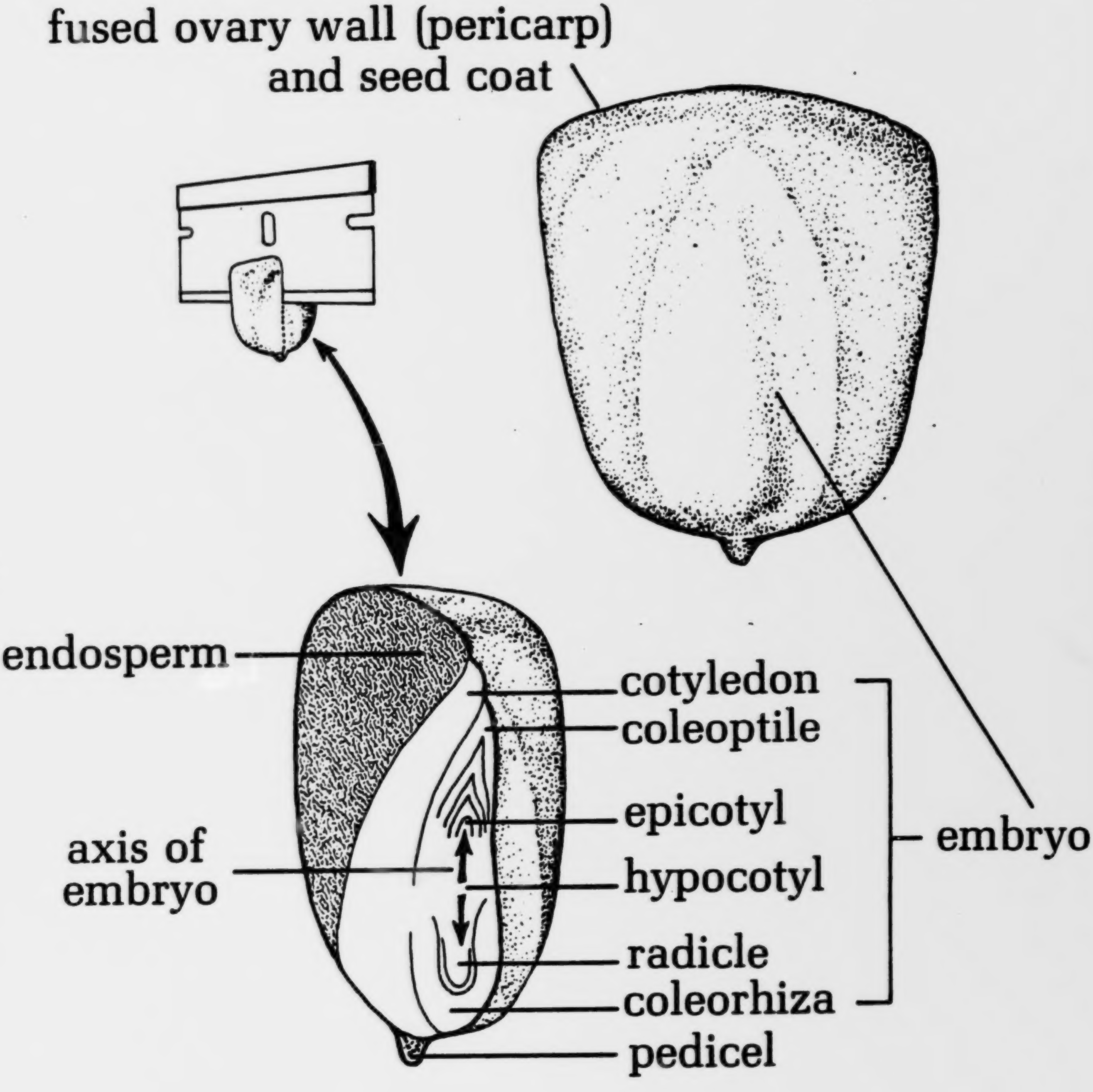
D. Birds

E. Man

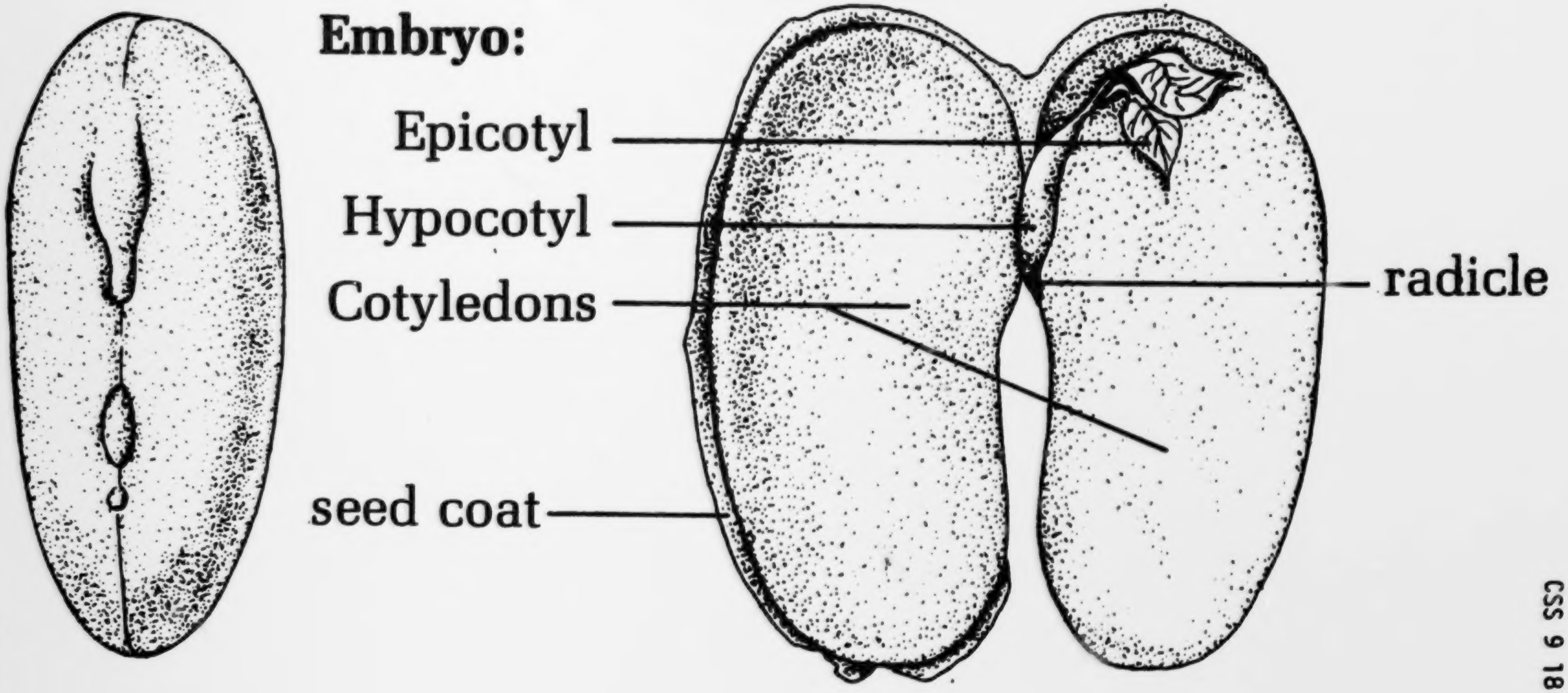
XXII. Fertilization

A. After a pollen grain alights on the surface of the stigma, it forms a pollen tube. The pollen tube grows down the style to the ovary. It penetrates the ovary and the male cell unites with the ovule. This is called fertilization, the union of the male and female cells. The result is a zygote. Cell division takes place and the zygote becomes the embryo of the seed.

A CORN GRAIN AND ITS PARTS


fused ovary wall (pericarp)
and seed coat
endosperm
cotyledon
coleoptile
epicotyl
axis of
embryo
hypocotyl
radicle
coleorhiza
pedicel
embryo

A BEAN SEED AND ITS PARTS



Embryo:

Epicotyl

Hypocotyl

Cotyledons

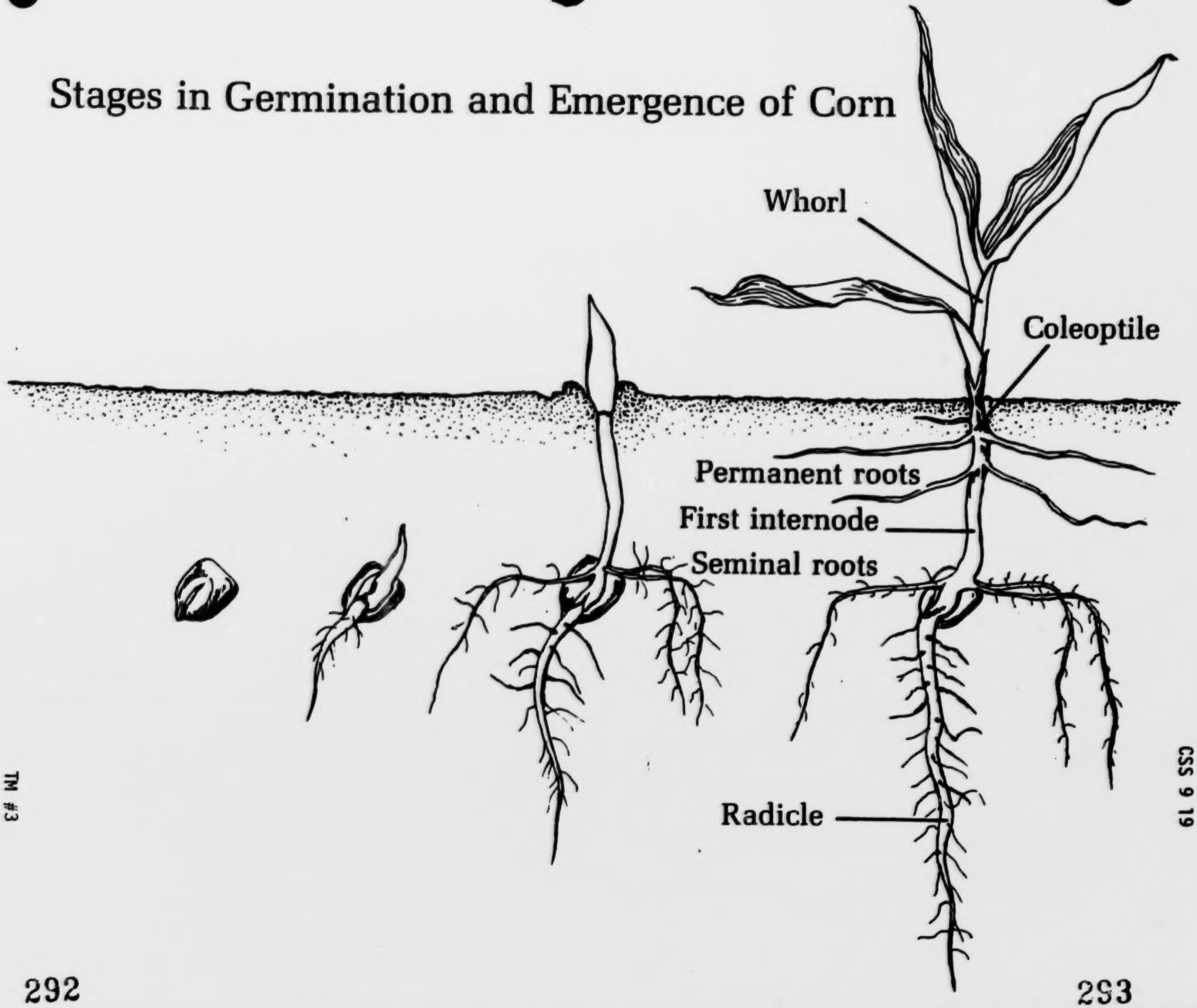
seed coat

radicle

TM #2

CSS 9 18

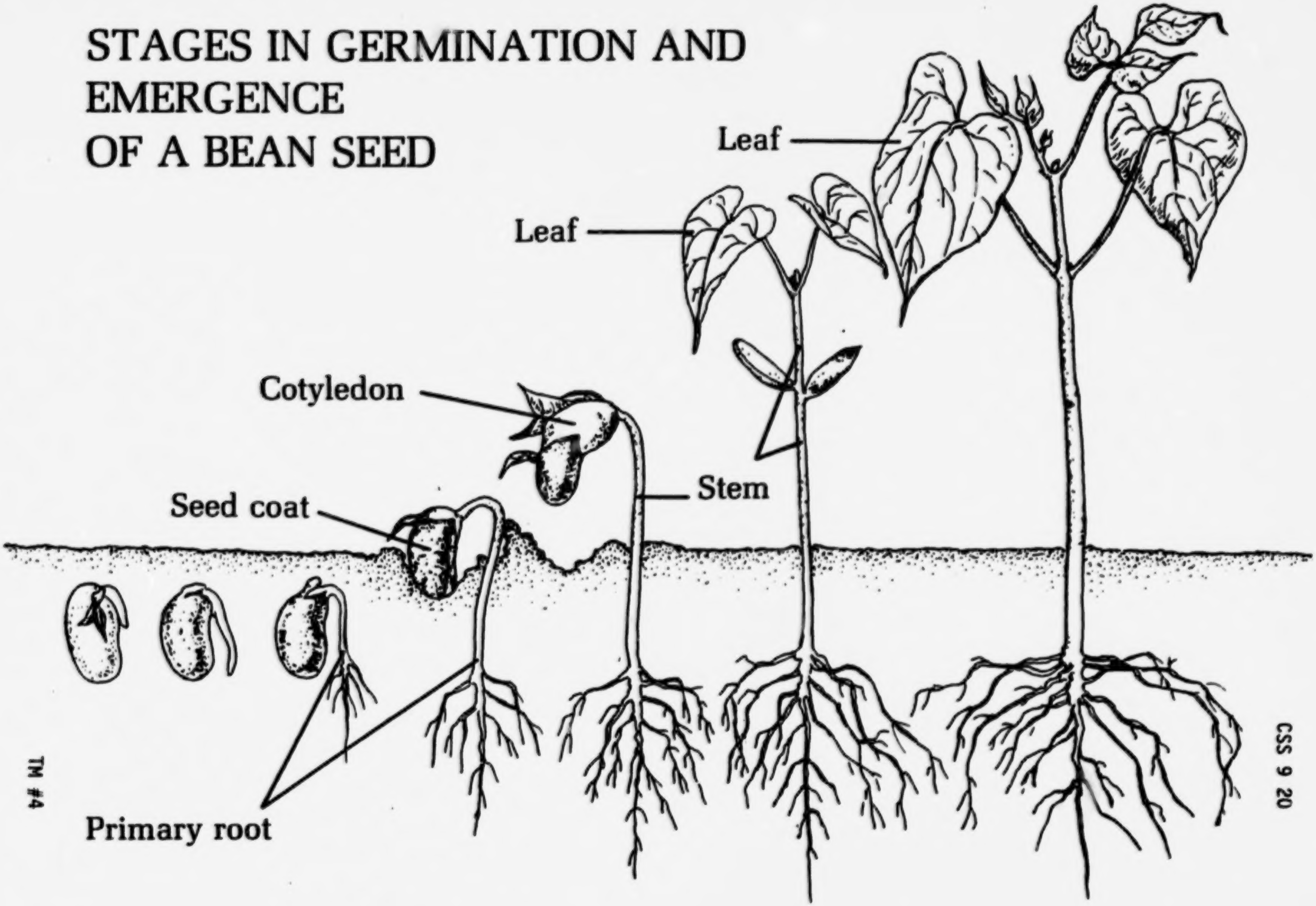
Stages in Germination and Emergence of Corn


Whorl
Coleoptile
Permanent roots
First internode
Seminal roots
Radicle

TM #3

CSS 9 19

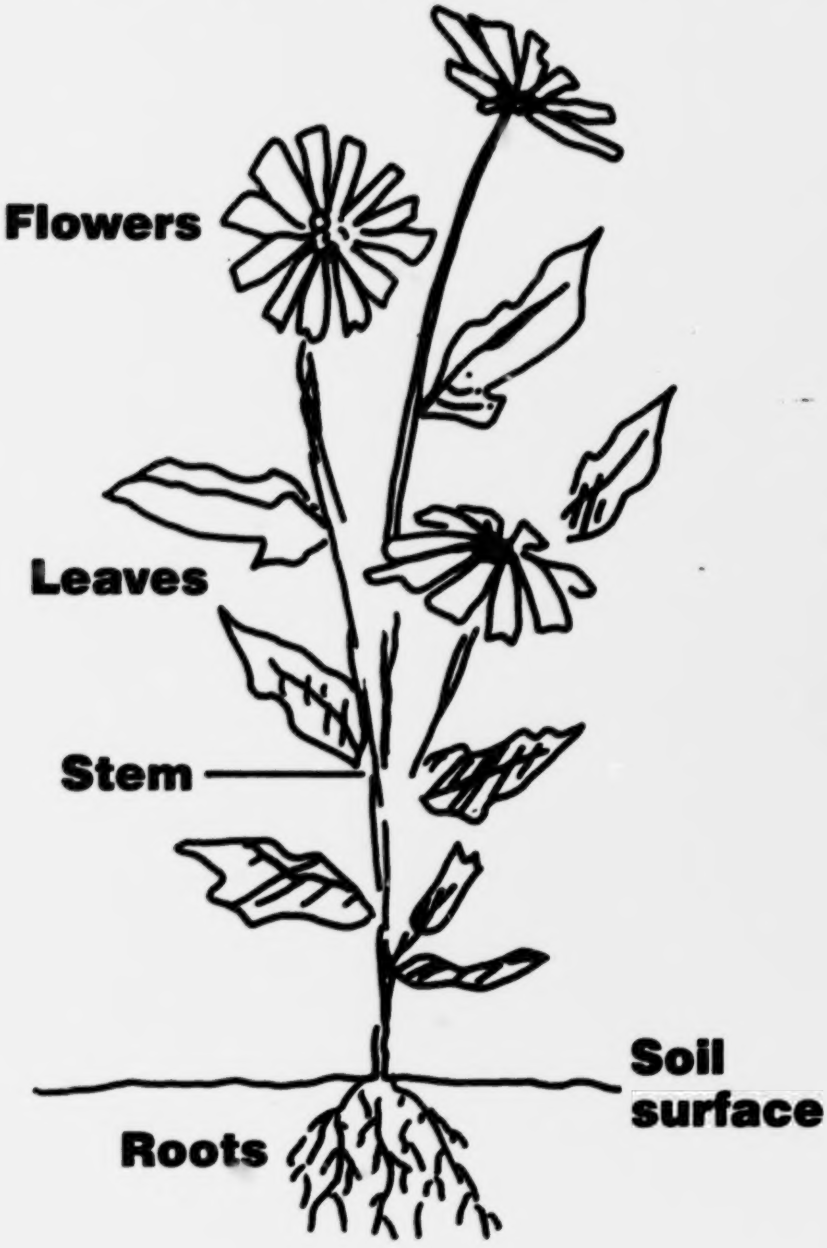
STAGES IN GERMINATION AND EMERGENCE OF A BEAN SEED


Leaf
Leaf
Cotyledon
Stem
Seed coat
Primary root

TM #4

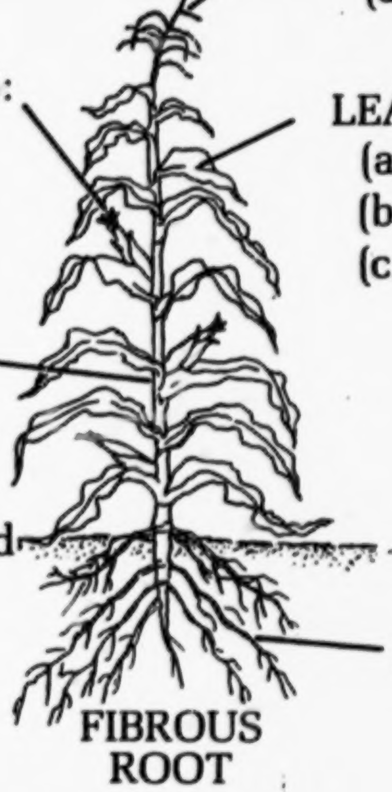
CSS 9 20

Primary Parts of a Plant


Flowers
Leaves
Stem
Soil surface
Roots

TM #5

Functions of Leaves, Stems, Roots, and Flowers



MALE FLOWER FUNCTION:
(a.) Pollination

FEMALE FLOWER FUNCTIONS:
(a.) Reproduction
(b.) Store food - - in seeds and fruits

LEAF FUNCTIONS:
(a.) Photosynthesis
(b.) Transpiration
(c.) Food storage in some crops, ie. lettuce, cabbage

STEM FUNCTIONS:
(a.) Conducts water and raw minerals from soil to leaves
(b.) Conducts manufactured food from leaves to other plant parts
(c.) Produces leaves and displays them to light
(d.) Supports leaves, flowers and fruit
(e.) Stores food reserves in some plants - - Irish potato, asparagus, cabbage hearts, etc.

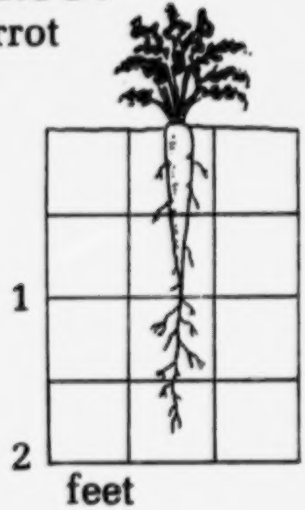
ROOT FUNCTIONS:
(a.) Absorb water and raw minerals
(b.) Anchor plant
(c.) Store food reserves - - in some crops - carrots, beets, turnips

TM #6

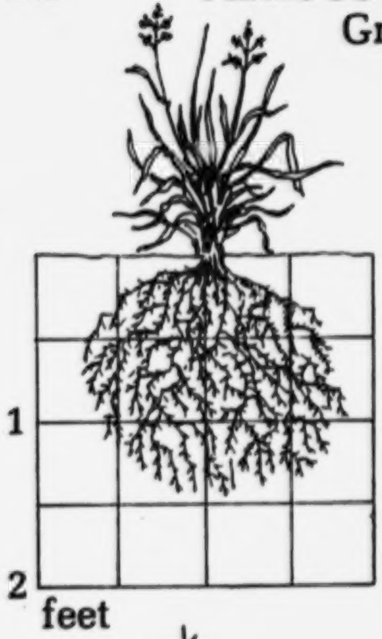
CSS 9 22

TAP AND FIBROUS ROOTS

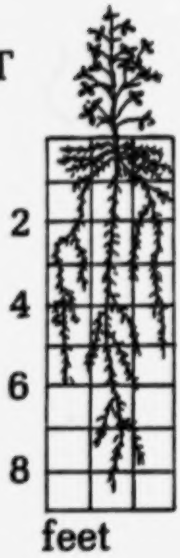
TAPROOT
Carrot



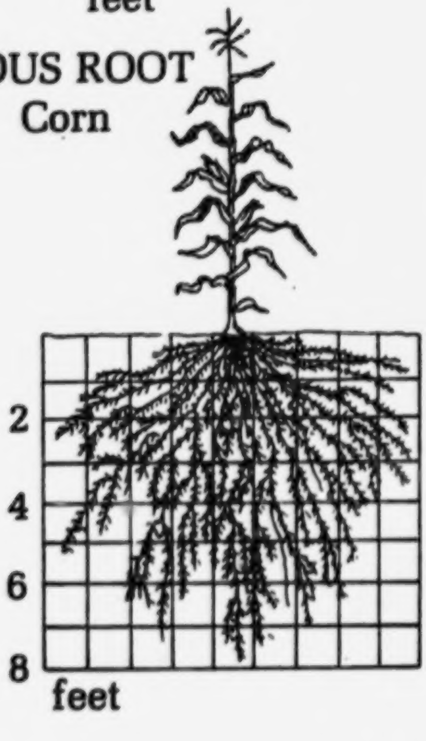
FIBROUS ROOT
Grass



TAPROOT
Alfalfa

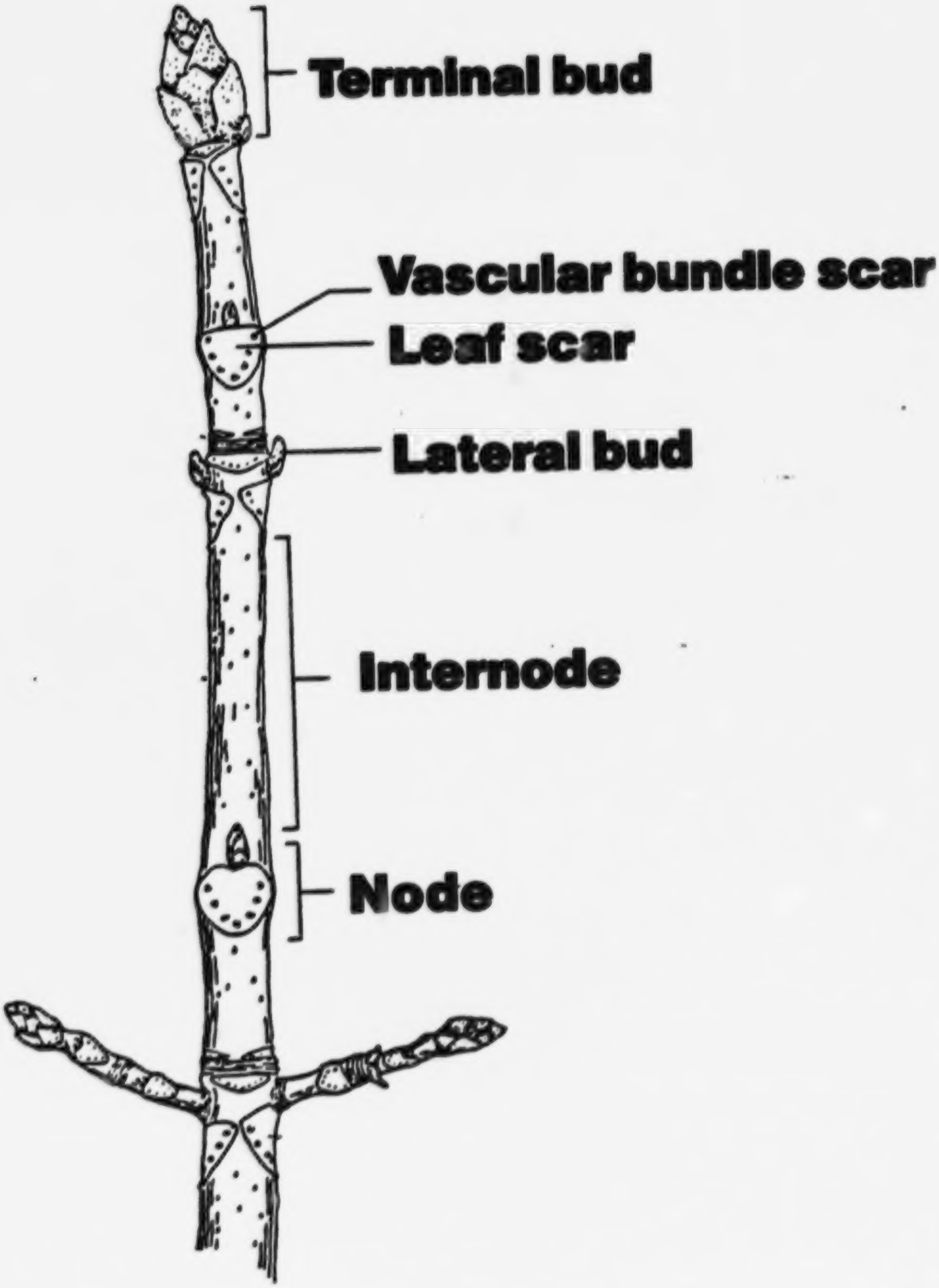


FIBROUS ROOT
Corn

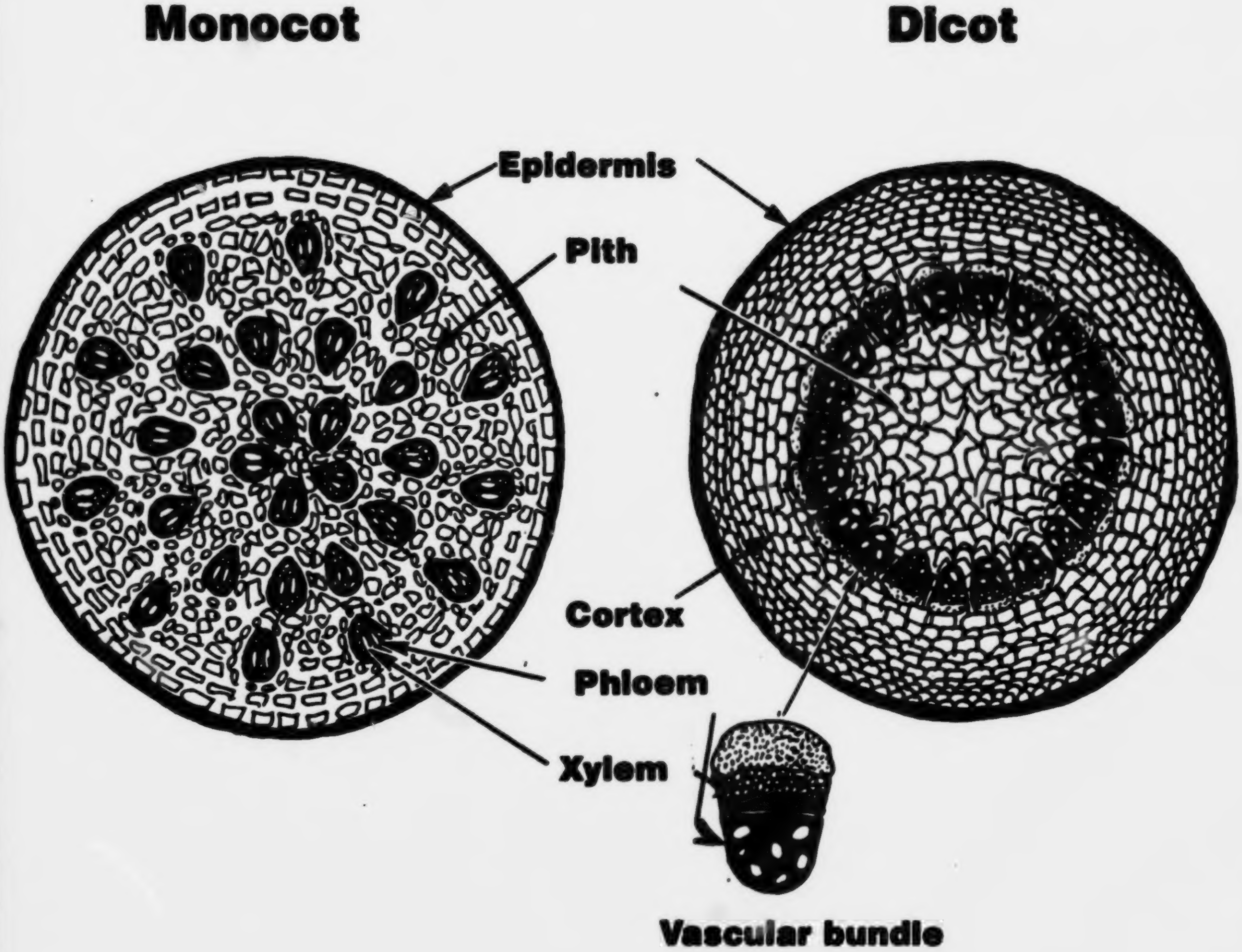


TM #7

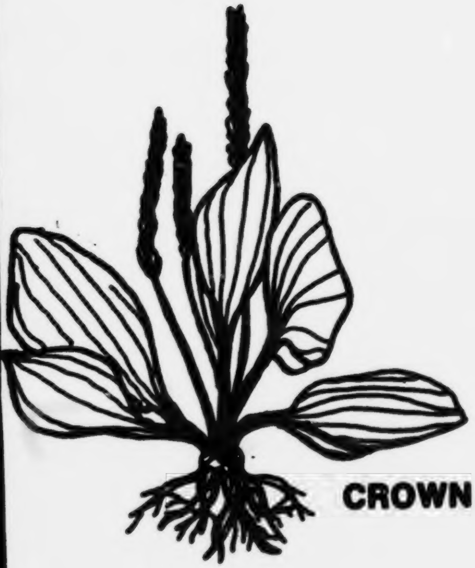
Parts of the Stem


Terminal bud
Vascular bundle scar
Leaf scar
Lateral bud
Internode
Node

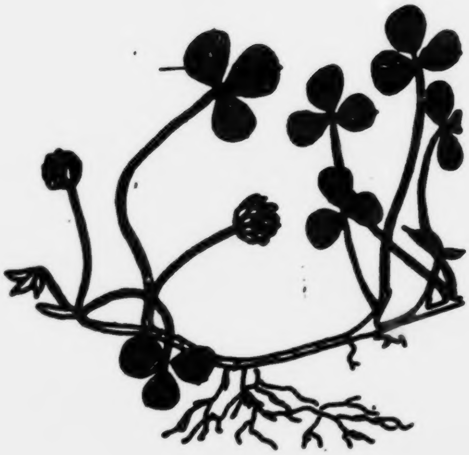
Arrangement of Tissue in Stems


Monocot
Dicot
Epidermis
Pith
Cortex
Phloem
Xylem
Vascular bundle

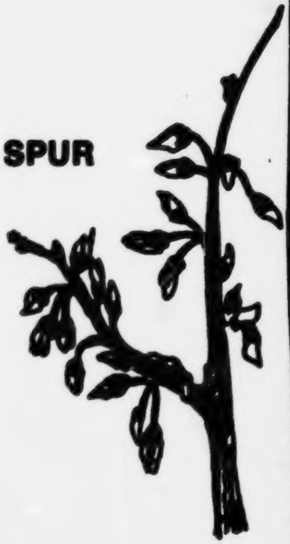
ABOVEGROUND STEM MODIFICATIONS



CROWN

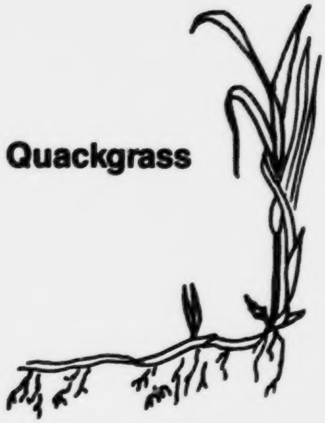


STOLON



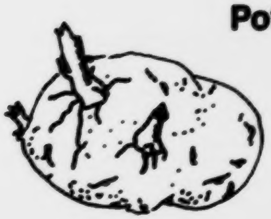
SPUR

Below Ground Stem Modifications



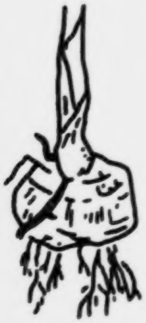
Quackgrass

Rhizomes



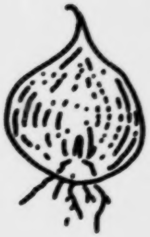
Potato

Tuber



Gladiolus

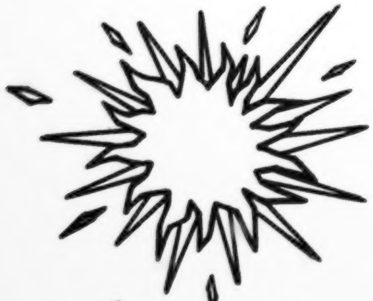
Corm



Onion

Bulbs

Conditions Affecting the Vegetative Growth of Crop Plants



1. Climate

2. Soil features

3. Crop pests

4. Crop being produced

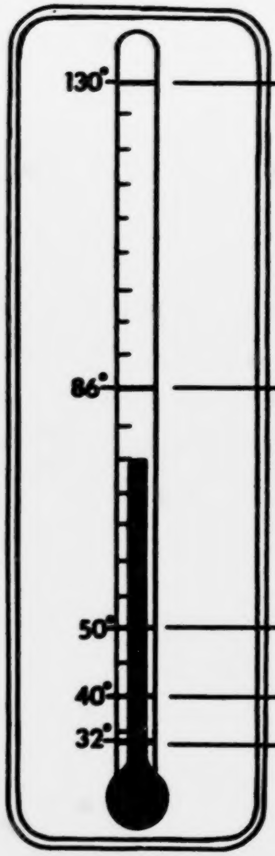
5. Economics

Comparison of Utilization of Sunlight by Crop Plants.*

Crop	Yield	Total Dry Matter
Corn	150 bu.	19,500
Soybeans	45 bu.	5,700
Wheat	50 bu.	6,000
Oats	80 bu.	6,560
Alfalfa	6 tons	12,000
Red Clover	3 tons	6,000
Mixed hay (50% legume)	5 tons	10,000
Pasture	—	6,000

*More efficient use of sunlight by a crop plant will result in higher yields, if other factors are not limiting.

PLANT GROWTH VARIANCE WITH TEMPERATURE CHANGE



Plants die above this temperature
Above 130° the enzyme systems break down — no growth

Maximum temperature for corn and most plants — growth slows
Best range for most crop growth

Base temperature for corn

Base temperature for many plants
Below this temperature the enzyme systems are inactive — no growth

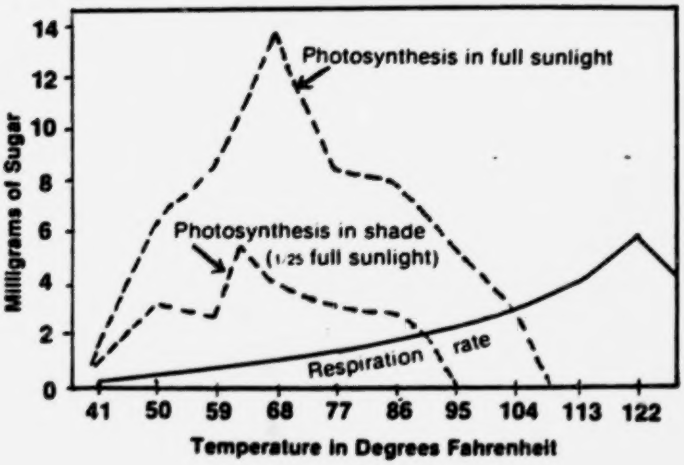
Freezing

TM #14

CSS 9 30

CSS 9 31

Rate of Photosynthesis and Respiration as Affected by Temperature



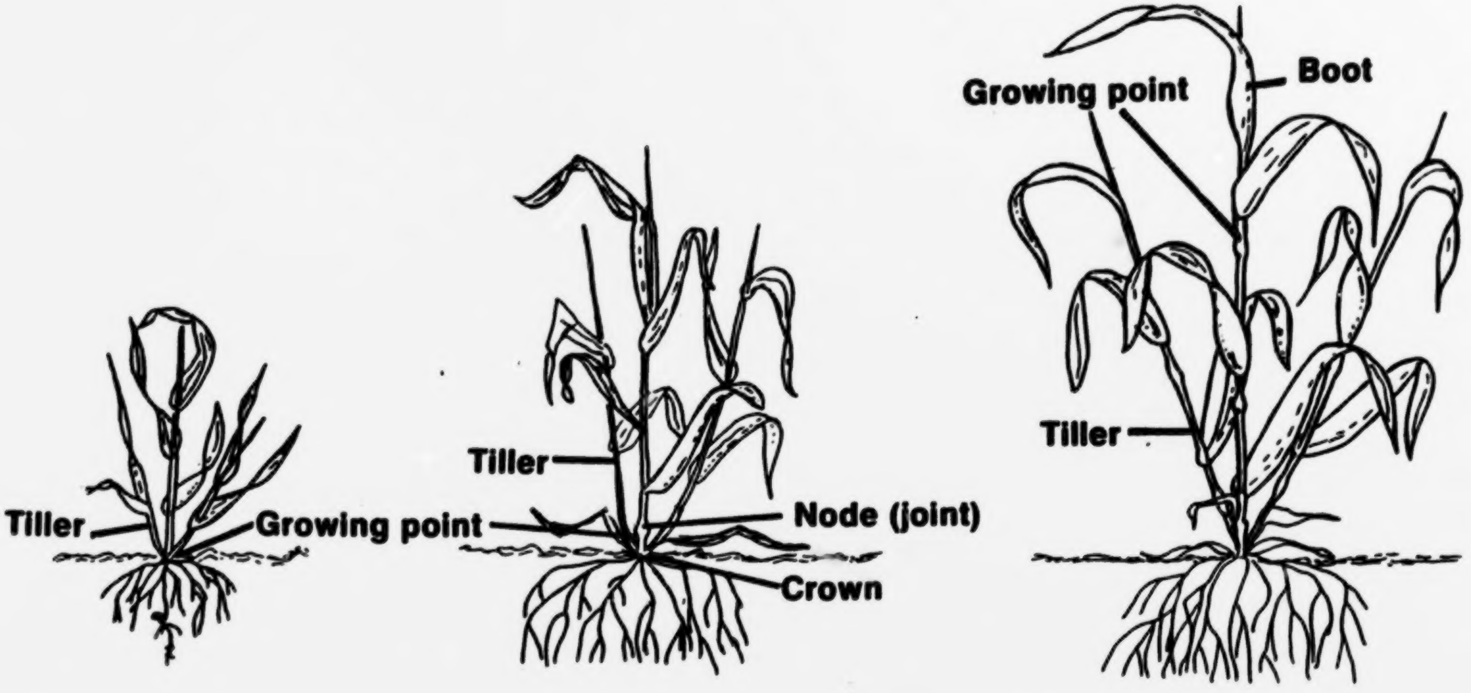
TM #15

Approximate Pounds of Water Required to Produce One Pound of Dry Matter*

Crop	Pounds of Water
Corn	350
Soybeans	650
Wheat and Oats	550
Alfalfa	850
Red Clover	650

*The availability of water, either by precipitation or irrigation, influences crop yield more than any other factor.

VEGETATIVE GROWTH STAGES OF WHEAT


Tiller
Growing point
Tiller
Node (joint)
Crown
Growing point
Boot
Tiller

TILLERING STAGE

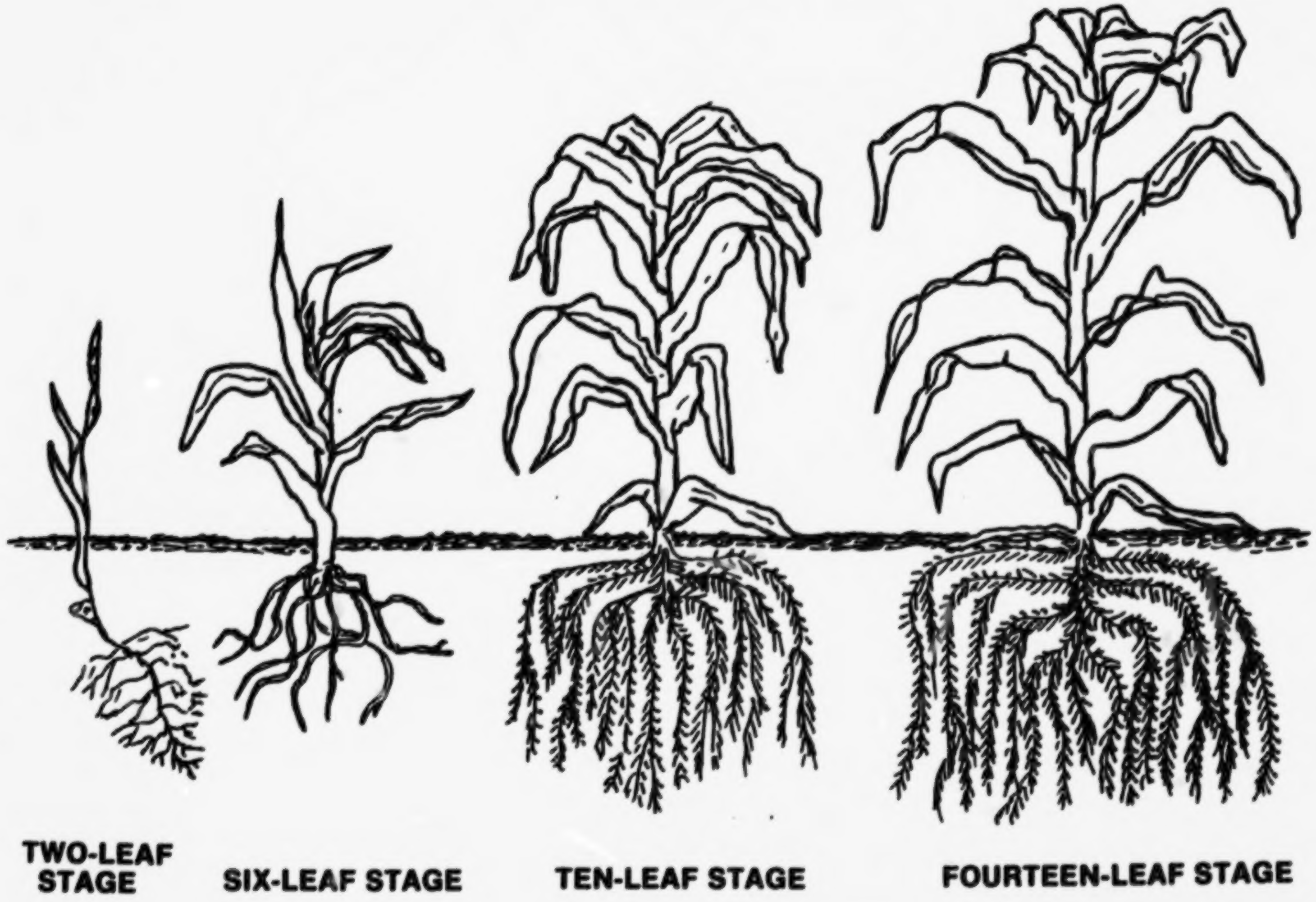
JOINT STAGE

BOOT STAGE

TM #17

CSS 9 33

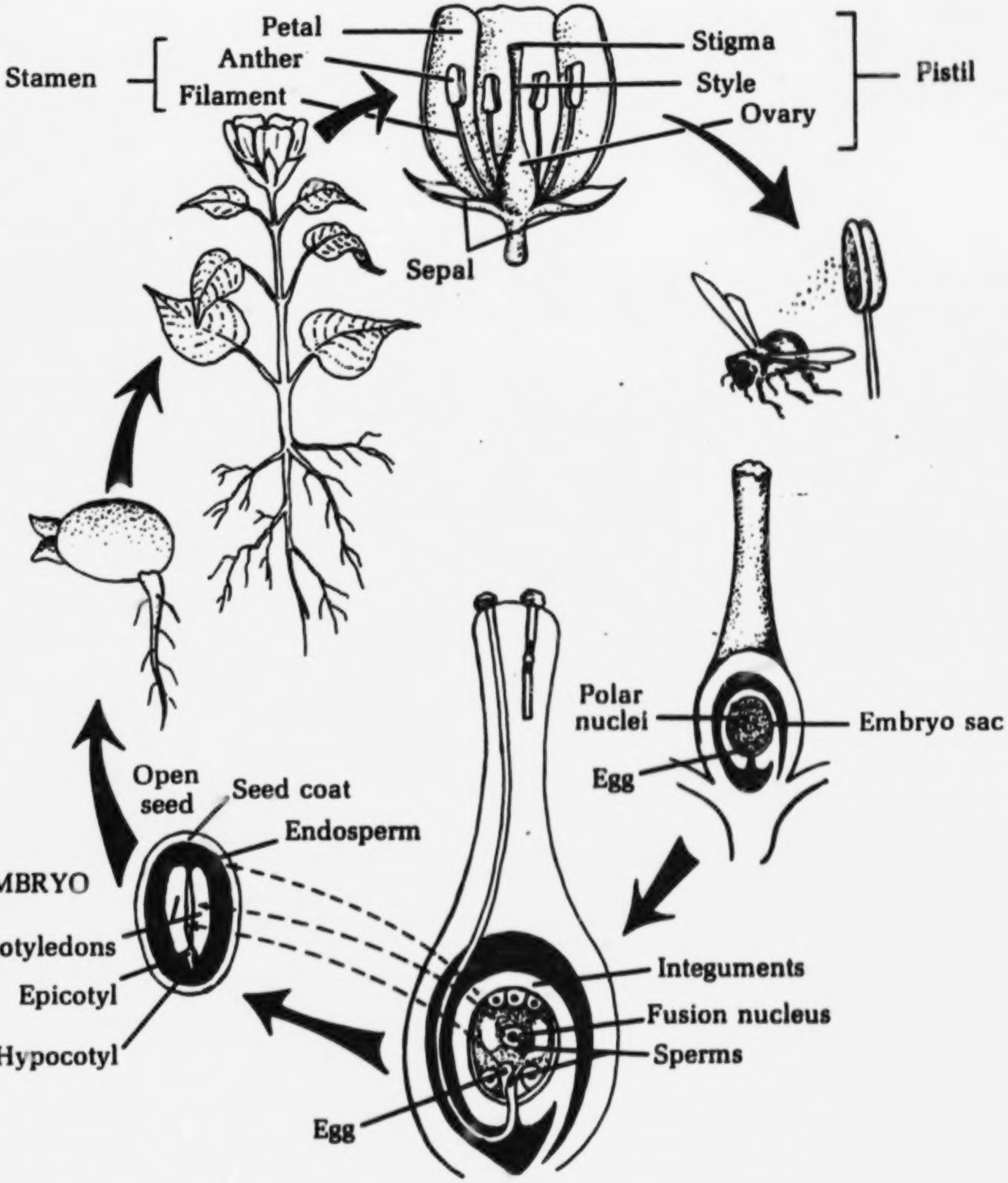
VEGETATIVE GROWTH STAGES OF CORN


TWO-LEAF STAGE
SIX-LEAF STAGE
TEN-LEAF STAGE
FOURTEEN-LEAF STAGE

TM #18

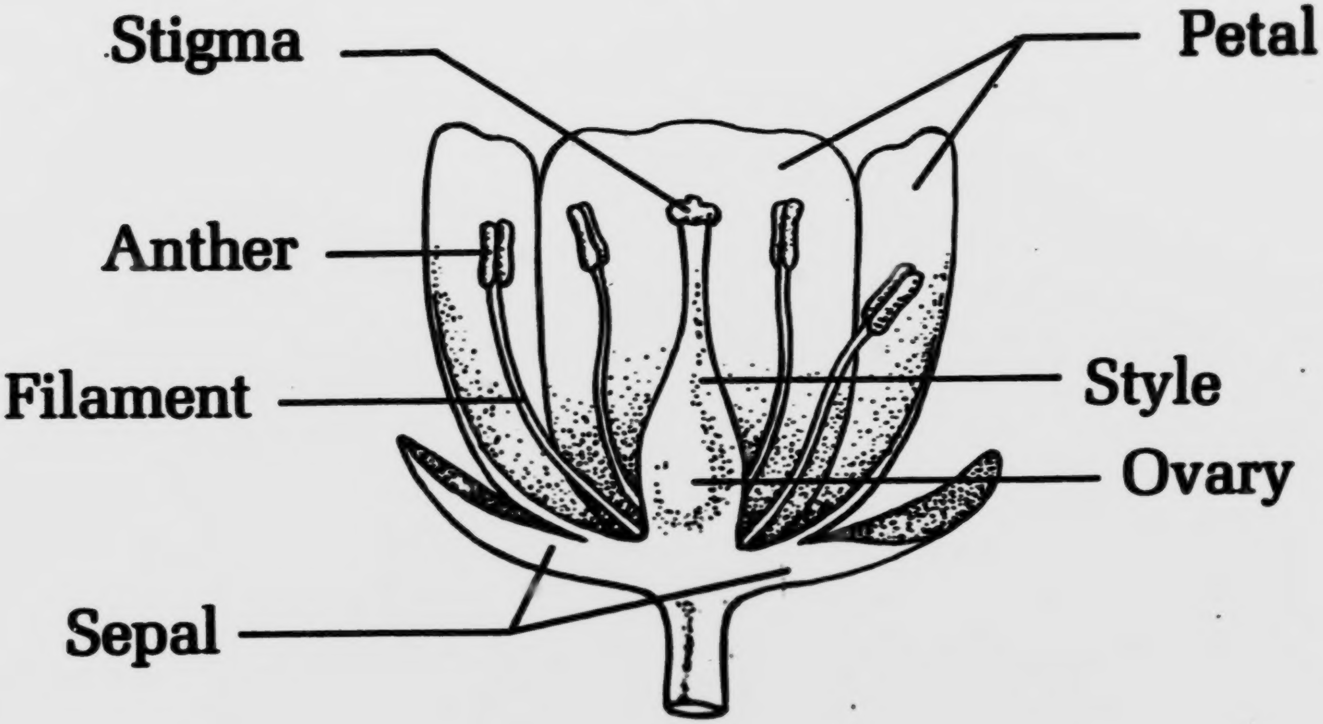
CSS 9 34

The Life Cycle of a Flowering Plant


Petal
Stamen
Anther
Filament
Stigma
Style
Ovary
Pistil
Sepal
Polar nuclei
Embryo sac
Egg
Open seed
Seed coat
Endosperm
EMBRYO
Cotyledons
Epicotyl
Hypocotyl
Integuments
Fusion nucleus
Sperms
Egg

TM #19

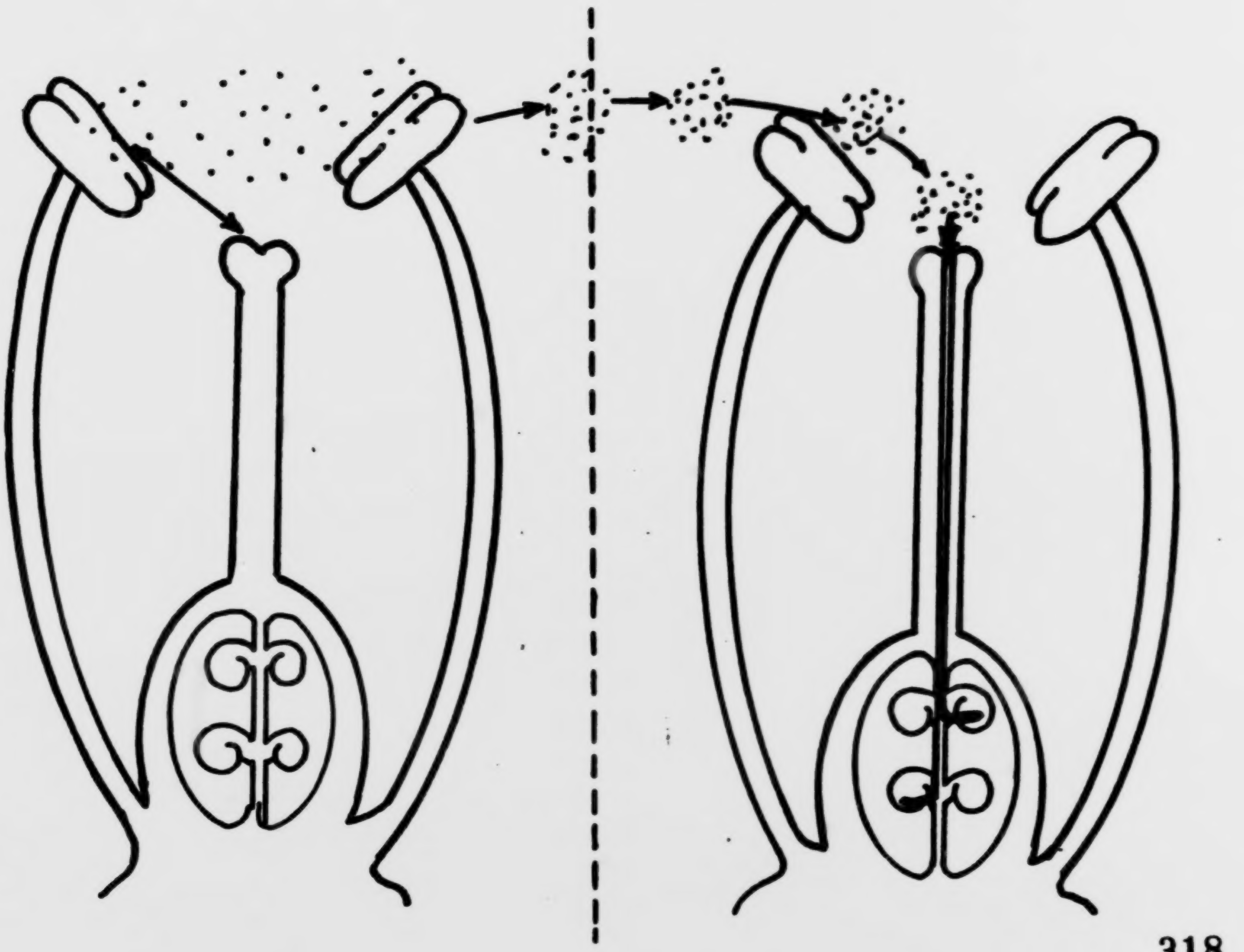
Parts of a Complete Flower


Stigma
Petal
Anther
Filament
Style
Ovary
Sepal

TM #20

CSS 9 36

SELF-POLLINATION AND CROSS-POLLINATION



TM #21

CSS 9 37

PLANT GROWTH AND DEVELOPMENT
UNIT 9

TEST

Name_______________________________ Score_______________

1. Match terms associated with plant growth and development to the correct definitions. Write the correct numbers in the blanks.

    1. Node
    2. Internode
    3. Bud
    4. Leaf scar
    5. Vascular bundle scar
    6. Monocot
    7. Dicot
    8. Vascular bundle
    9. Xylem
    10. Phloem
    11. Pistil
    12. Stamen
    13. Fertilization
    14. Pollination
    15. Embryo
    16. Radicle
    17. Hypocotyl
    18. Epicotyl

_____a. Union of the male (pollen) nucleus with the female (egg) cell

_____b. Plant having two seed leaves

_____c. The part of a stem between two nodes

_____d. Vascular tissue that transports water and minerals from the root system to the leaves

_____e. The embryonic root

_____f. Seed bearing organ of a flower; composed of ovary, style, and stigma

_____g. Plant having one seed leaf

_____h. The part of a stem where a leaf is attached

_____i. An embryonic shoot of a plant

_____j. The part of the embryo above the cotyledons and below the next leaves

_____k. A scar left on the stem when a leaf falls

_____l. Transfer of pollen from the anther to the stigma

_____m. The young plantlet within the seed

TEST

_____n. The part of an embryo between the cotyledons and the radicle

_____o. Part of the flower producing the pollen; composed of the filament and anther

_____p. A strand of tissue containing xylem and phloem enclosed by a sheath of cells

_____q. A spot within a leaf scar left by the vascular bundles when a leaf falls

_____r. Vascular tissue that conducts food from the leaves to regions of growth or storage

2. Name the three stages of plant growth and development.

a. ________________________________

b. ________________________________

c. ________________________________

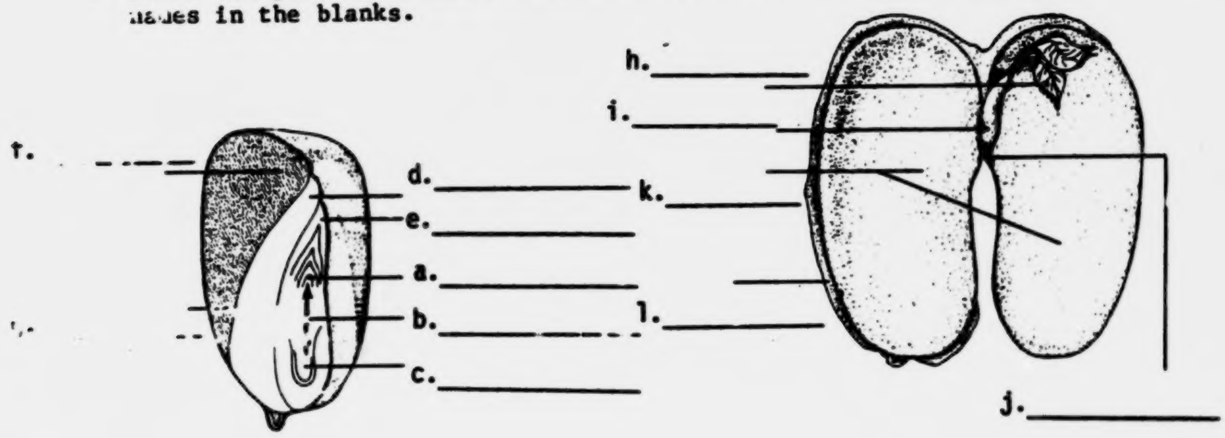
Name three requirements for good seed germination.

a. ________________________________

b. ________________________________

c. ________________________________

. Label the parts of a monocot and a dicot seed. Write the correct names in the blanks.



BEST COPY AVAILABLE

TEST

5. Arrange in order the stages of germination. Write a "1" before the first step, a "2" before the second step, and so on.

A. Monocot

_____a. The coleoptile emerges

_____b. The epicotyl elongates, the coleoptile piercing the soil as it grows upward

_____c. Absorption of water and oxygen into seed

_____d. The coleoptile unfolds

_____e. The seed coat ruptures and the radicle begins to grow downward

B. Dicot

_____a. The seed coat ruptures and the radicle begins to grow downward

_____b. Emergence of seedling

_____c. The hypocotyl pulls the cotyledons toward the soil surface

_____d. The cotyledons spread apart and the stem tip is exposed

_____e. Absorption of water and oxygen into seed

6. Select from the following list factors that cause poor seed germination. Write an "X" in the blank before each correct answer.

_____a. Number of seeds per pound

_____b. Seeds planted too deeply in soil

_____c. Presence of hardpan in root zone

_____d. Fungal disease

_____e. Low soil temperature

_____f. Low soil moisture

_____g. Damaged seed

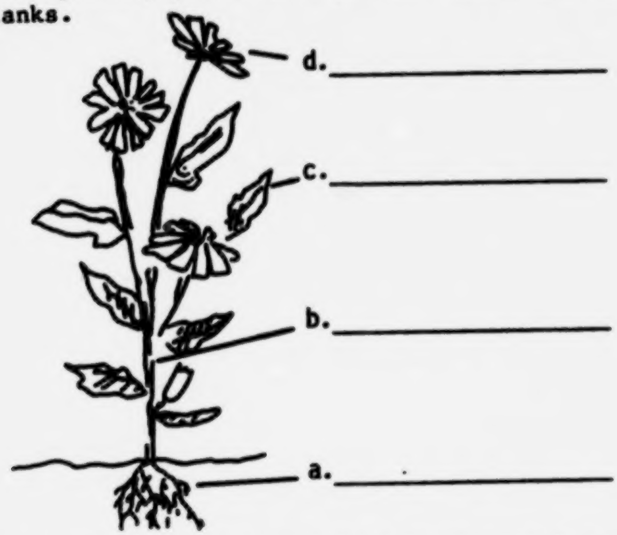
_____h. Deficiency of nutrients in soil

_____i. Period of time between harvesting and planting of seed

_____j. Conditions under which seed is stored

TEST

7. Label the primary parts of a plant. Write the correct names in the blanks.



8. Match the primary plant part to its correct function. Write the correct numbers in the blanks.

1. Roots
2. Stems
3. Leaves
4. Flowers

_____a. Absorb water and nutrients; anchors and supports the plant; site of food storage in carrots

_____b. Site of photosynthesis; necessary for transpiration; site of food storage in lettuce

_____c. Support leaves and flowers; conducts water, nutrients, and food; site of food storage in potatoes

_____d. Site of reproduction; site of food storage in apples

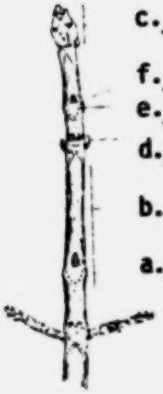
9. Name two types of root systems.

a. ________________________________

b. ________________________________

TEST

10. Label the parts of a stem. Write the correct names in the blanks.



c.____________________

f.____________________

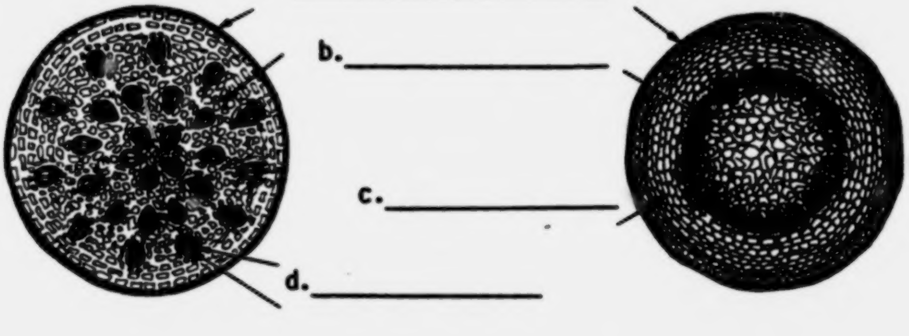
e.____________________

d.____________________

b.____________________

a.____________________

11. Label the tissues in a monocot and dicot stem. Write the correct names in the blanks.



a.____________________

b.____________________

c.____________________

d.____________________

12. Match the stem modification with the correct description. Write the correct numbers in the blanks.

1. Crown
2. Stolon
3. Spur
4. Rhizome
5. Tuber
6. Corn
7. Bulb

_____a. Enlarged fleshy part found at the tip of a rhizome; potato

_____b. Appears laterally on branches of fruit trees and bears fruit; apple _____c. Short disc-shaped stem surrounded by leaf-like scales; onion

_____d. Fleshy, short underground stem with very few buds; gladiolus

_____e. Runners that grow along top of soil surface; strawberry

_____f. Underground stems that grow horizontally below soil surface; quackgrass

_____g. Appears just above or just below ground level from which modified stems grow; small grains

13. Select from the following list conditions affecting the vegetative growth of crop plants. Write an "X" in the blank before each correct answer.

_____a. Soil fertility

_____b. Amount of erosion

_____c. Depth seed is planted

_____d. Amount of rainfall

_____e. Presence of weeds

_____f. Soil moisture

_____g. Crop being produced

_____h. Presence of insects

_____i. Soil compaction

_____j. Presence of disease

14. Name the three vegetative growth stages of small grains.

a. ______________________________

b. ______________________________

____

TEST

15. Name the four vegetative growth stages of corn.

a. ______________________________________

b. ______________________________________

c. ______________________________________

d. ______________________________________

16. Name two means of reproduction by plants.

a. ______________________________________

b. ______________________________________

17. Arrange in order the life cycle of a flowering plant. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Pollination

_____b. Flower formation

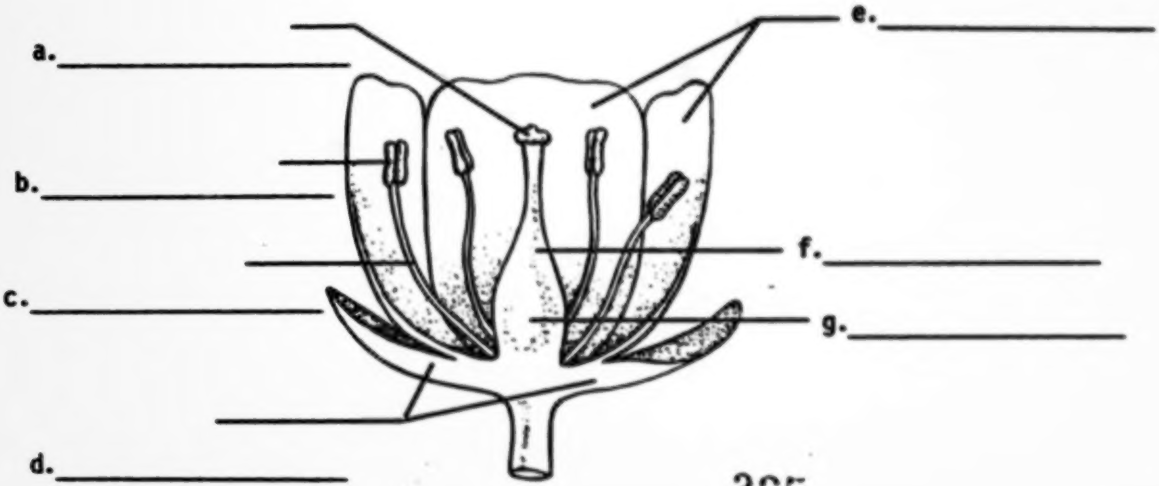
_____c. Seed germination and seedling growth

_____d. Fertilization

_____e. Seed development

_____f. Vegetative growth

18. Label the parts of a complete flower. Write the correct names in the blanks.



TEST

19. Match the type of flower to the correct description. Write the correct numbers in the blanks.

1.	Complete	5.	Staminate
2.	Incomplete	6.	Pistillate
3.	Perfect	7.	Monoecious
4.	Imperfect	8.	Dioecious

_____a. Has only male flower parts

_____b. Has stamens and pistils, but no petals or sepals; common to monocots

_____c. Staminate and pistillate flowers found on the same plant; corn

_____d. Has both stamens and pistils on the same flower

_____e. Has only female flower parts

_____f. Staminate and pistillate flowers found on separate plants; spinach

_____g. Has stamens, pistils, petals, and sepals on the same flower; common to dicots

_____h. Has either stamens or pistils, but not both on the same flower

20. Match the types of pollination to the correct description. Write the correct numbers in the blanks.

1. Self-pollination
2. Cross-pollination

_____a. Transfer of pollen from the anthers to the stigma of the same flower

_____b. Transfer of pollen from the anthers of one plant to the stigmas of another plant

21. Name three ways pollen is moved.

a. ____

b. ____

c. ____

TEST

22. Explain the process of fertilization in plants.

PLANT GROWTH AND DEVELOPMENT
UNIT 9

ANSWERS TO TEST

1. a. 13
   b. 7
   c. 2
   d. 9
   e. 16
   f. 11
   g. 6
   h. 1
   i. 3
   j. 18
   k. 4
   l. 14
   m. 15
   n. 17
   o. 12
   p. 8
   q. 5
   r. 10

2. a. Seed germination and seedling growth
   b. Vegetative
   c. Reproduction

3. a. Proper temperature
   b. Sufficient moisture
   c. Ample supply of oxygen

4. a. Epicotyl
   b. Hypocotyl
   c. Radicle
   d. Cotyledon
   e. Coleoptile
   f. Endosperm
   g. Seed coat
   h. Epicotyl
   i. Hypocotyl
   j. Radicle
   k. Cotyledons
   l. Seed coat

5. (1) a. 4 b. 3 c. 1 d. 5 e. 2
   (2) a. 2 b. 4 c. 3 d. 5 e. 1

6. b, d, e, f, g, i, j

7. a. Roots
   b. Stem
   c. Leaves
   d. Flowers

8. a. 1 b. 3 c. 2 d. 4

9. a. Tap root system
   b. Fibrous root system

10. a. Node
    b. Internode
    c. Terminal bud
    d. Lateral bud
    e. Leaf scar
    f. Vascular bundle scar

11. a. Epidermis
    b. Pith
    c. Vascular bundles
    d. Cortex

12. a. 5
    b. 3
    c. 7
    d. 6
    e. 2
    f. 4
    g. 1

ANSWERS TO TEST

13. a, b, d, e, f, g, h, i, j

14. a. Tillering
    b. Jointing
    c. Boot

15. a. Two-leaf stage
    b. Six-leaf stage
    c. Ten-leaf stage
    d. Fourteen-leaf stage

16. a. Asexual
    b. Sexual

17. a. 4 b. 3 c. 1 d. 5 e. 6 f. 2

18. a. Stigma
    b. Anther
    c. Filament
    d. Sepal
    e. Petal
    f. Style
    g. Ovary

19. a. 5
    b. 2
    c. 7
    d. 3
    e. 6
    f. 8
    g. 1
    h. 4

20. a. 1 b. 2

21. Answer should contain three of the following

    a. Gravity
    b. Wind
    c. Insects
    d. Birds
    e. Man

22. Evaluated to satisfaction of instructor

CROP AND WEED IDENTIFICATION
UNIT 10

UNIT OBJECTIVE

After completing this unit the student should be able to match terms and definitions and identify the parts of a leaf, flower and stem. The student should also be able to classify plants and identify common crop and weed plants. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with crop and weed identification to the correct definition.
2. Discuss why we need to identify plants.
3. Select from a list reasons plant identification cannot be made easy.
4. Arrange in order the binomial system of plant classification.
5. Name three classifications of plants by life cycle.
6. Name three classifications of plants by difficulty of control.
7. Label a drawing showing the parts of a simple leaf.
8. Label a drawing showing the parts of a compound leaf.
9. Identify two types of compound leaves.
10. Identify three types of leaf arrangement.
11. Identify four types of leaf veination.
12. Identify three types of leaf margins.
13. Identify four types of leaf attachment to the stem.
14. Label a drawing showing the parts of a stem.
15. Match stem modifications to the correct description.
16. Label a drawing showing the parts of a complete flower.
17. Match the type of flower to the correct description.

OBJECTIVE SHEET

18. Identify four types of inflorescence.

19. Name two types of root systems.

20. Select the correct plant family when given the common name of a plant.

21. Name three natural resourses crops and weeds are in competition for.

22. Name three losses caused by weeds.

23. Select from a list ways that weeds spread.

24. Match the general categories of weed control to the correct description.

25. Select from a list methods of cultural weed control.

26. Select from a list methods of mechanical weed control.

27. Match the classifications of herbicides to the correct description.

CROP AND WEED IDENTIFICATION
UNIT 10

SUGGESTED ACTIVITIES

I. Suggested activities

A. Order materials to supplement unit

1. Literature

a. Weeds, instructional unit; available from: Agri-Farm Publications, Inc., 1019 Market Street, Gowrie, IA, 50543; approximate cost $17.50; order no. 209.

b. Crop Plants, 80-page manual, color photos and descriptions; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland Dr., Urbana, Illinois, 61801; approximate cost $12.00.

c. Weed Plants, 80-page manual, color photos and descriptions; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland Dr., Urbana, Illinois, 61801; approximate cost $12.00.

2. Filmstrips, slideshows, etc.

a. Crop Seed Identification, 105 slides and cassette, 28 minutes; available from: Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $41.60, order no. D1.

b. Weeds and Weed Seed Identification, 29 slides and cassette; available from: Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $120.64, order no. D2.

c. Seedling Identification of Legume Plants, 24 slides and cassette; available from: Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $31.20, order no. D6.

d. Weed Identification, filmstrip or slide set; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland, Dr., Urbana, Illinois, 61801.

e. Identification of Weed Seedling - Broadleaf, filmstrip or slide set; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland, Dr., Urbana, Illinois, 61801; 2 parts.

SUGGESTED ACTIVITIES

f. Identification of Weed Seedling - Grasses, filmstrip or slide set; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland, Dr., Urbana, Illinois, 61801.

g. An Aid to Identifying 70 Crop and Weed Plants, slides, script and manual; available from Ohio Agricultural Education Curriculum Materials Center, Ohio State University, Columbus, OH, 43210; approximate cost $23.00; order no. 1005M, 10065.

h. Fundamentals of Plant Identification, slides and manual; available from Ohio Agricultural Education Curriculum Materials Center, Ohio State University, Columbus, OH, 43210; approximate cost $8.50; order no. 1008M, 1009S.

i. Weed Seed Identification Kit, 30 weed seeds in plastic holders on 3" X 5" cards; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $12.50, order no. 450.

j. Agricultural Weed Identification, 40 slides, available from VEP, Cal Poly State University, San Luis Obispo, CA, 93407; approximate cost $25.25.

3. Films

B. Make transparencies

C. Provide students with objective sheet

D. Provide students with information sheet

E. Discuss unit and specific objectives

F. Discuss information sheet

G. Invite county weed supervisor to speak on noxious weed laws, identification and control

SUGGESTED ACTIVITIES

H. Tour county with students, parents, etc. to determine the status of noxious and common weeds in your locality

I. Have a weed collection and identification contest. Student collect pressed samples of weeds, identify them, and submit to the instructor. The student with the largest number of different weed/crop specimens wins. Save the collected samples for future classroom use.

J. Invite county agent, seed specialist, or other qualified person to speak to class on economics of weeds and weed control

K. Assign students or let them select an agronomic crop, identify problem weeds for that crop, and develop a weed control plan to use

L. Give test

M. Reteach if necessary

N. Retest

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Binomial system of plant classification
2. TM 2--Winter annuals
3. TM 3--Summer annuals
4. TM 4--Biennials
5. TM 5--Perennials
6. TM 6--Parts of a simple leaf
7. TM 7--Parts of a compound leaf
8. TM 8--Types of compound leaves
9. TM 9--Types of leaf arrangement

SUGGESTED ACTIVITIES

10. TM 10--Types of leaf veination
11. TM 11--Types of leaf margins
12. TM 12--Types of leaf attachment
13. TM 13--Parts of the stem
14. TM 14--Above ground stem modifications
15. TM 15--Below ground stem modification
16. TM 16--Parts of a complete flower
17. TM 17--Types of inflorescence
18. TM 18--Types of inflorescence (continued)
19. TM 19--Types of root systems

E. Test

F. Answers to test

III. Unit references

A. Gaines, X.M. and Swan, D.B. Weeds of Eastern Washington and Adjacent Areas. Spokane, WA. C.W. Hill Printers. Camp-Na-Bor-Lee Association, Inc.: 1972.

B. Erickson, L.C. How to Know the Weeds of Idaho. Moscow, ID. University of Idaho.

C. Harrington, H.D. and Durrell, L.W. How to Identify Plants. Athens, OH. Swallow Press Books and Ohio State University: 1981.

D. Baysinger, O.K. and Lee, G.A. 1979 Survey of Exotic Noxious Weeds in Idaho. Moscow, ID. University of Idaho. Agricultural Experiment Station.

E. Courson. R.L. Controlling Weeds. Champaign, Illinois. University of of Illinois at Urbana. Vocational Agriculture Service.

F. Anderson. W.P. Weed Science: Principles, 2nd eidtion. St. Paul, MN. West Publishing Co.: 1983.

G. Hughes. H.A. Crop Chemicals, 2nd edition. Moline, Illinois. John Deere Technical Services: 1982.

H. Chemical Weed Control. Oklahoma State Board for Vocational Technical Education. Stillwater, OK. Ag II: Unit VI.

SUGGESTED ACTIVITIES

I. Weed Control. College Station, Texas. Teaching Materials Center. Agriculture Education Department. Texas A & M University: Vo-ag II, Unit IV-E.

J. Callihan. R. "Plant Science 338: Weed Control". Class notes, Fall 1984, University of Idaho, Moscow, ID.

K. Naskali, R. "Biology 203: General Botany". Class notes. Fall 1983, University of Idaho, Moscow, ID.

CROP AND WEED IDENTIFICATION
UNIT 10

INFORMATION SHEET

I. Terms and definitions

A. Weed--Any plant that interferes with human affairs

B. Noxious weed--Any plant which is determined by a state agency to be injurious to public health, crops, livestock land, or other property

C. Shrub--A woody perennial plant smaller than a tree and usually with several basal stems

D. Herb--A plant with no persistent woody stem above ground

E. Vine--A plant climbing on some support, the stem not standing upright by itself

F. Tree--A perennial woody plant of considerable stature at maturity with one or few main trunks

G. Rosette--A dense basal cluster of leaves arranged in a circular fashion like the leaves of the common dandelion

H. Prostrate--Lying flat on the ground

I. Evergreen--Bearing green leaves throughout the year

J. Deciduous--Plants that shed their leaves annually

K. Alternate--Not opposite, one leaf at a node

L. Opposite--Leaves two at a node and situated across the stem from each other

M. Simple leaf--Of only one part, leaf not completely divided into separate segments

N. Compound leaf--A leaf completely separated into two or more leaflets

O. Midrib--The main or central rib of a leaf

P. Vein--Threads of vascular tissue in a leaf

Q. Blade--The expanded usually flat portion of a leaf or petal

R. Petiole--The stalk to a leaf blade or compound leaf

S. Pinnate--Compound leaf with the leaflets on opposite sides

INFORMATION SHEET

T. Internode--The part of a stem between two nodes

U. Node--The place on a stem where one or more leaves are attached

II. Why we need to identify plants

A. To recognize a problem, to seek a solution, to diagnose a condition

B. To be able to talk or write about the plant

(Note: When an object must be designated again and again, them some sort of name becomes a real need.)

C. To be able to look up information about the plant

(Note: Questions may arise like the following: Is the plant palatable to animals? Is it a weed and if so can it be controlled? Is it poisonous to man? These questions and many others may be answered very completely in various publications. However, all this information is ordinarily unavailable if the name of the plant is unknown.)

III. Plant identification cannot be made easy

A. There is a special procedure involved

B. Technical descriptive terms must be mastered

C. Constant practice is necessary

D. Microscopic detail is often necessary

IV. The binomial system of plant classification (Transparency #1)

(Note: Several hundred thousand species of plants exist in the world. Botanists have chosen to organize, classify, and group plants according to what they think has been their evolutionary development, with related plants near and unrelated plants far apart.)

A. Division--A group of related classes

B. Class--A group of related orders

C. Order--A group of related families

D. Family--A group of related genera

E. Genus--A group of related species

F. Species--The plants of one kind

INFORMATION SHEET

Example:

CORN

Category	Name	Description
Division	Anthophyta	Vascular plants with seeds and flowers; ovules enclosed in an ovary, pollination indirect; the angiosperms.
Class	Monocotyledonae	Embryo with one cotyledon, flower parts usually in threes; many scattered vascular bundles in stem
Order	Commelinales	Monocots with fibrous leaves; reduction and fusion in flower parts
Family	Poaceae	Hollow stemmed monocots with reduced greenish flowers; fruit a specialized achene; the grasses
Genus	Zea	Robust grasses with separate staminate and pistallate flower clusters
Species	Zea Mays	Corn

V. Classification of plants by life cycle (Transparencies #2, #3, #4, and #5)

   A. Annual--Completes life cycle within the period of one year

   B. Biennial--Forms rosette in the first year and in the second year flowers, produces seed, and dies

   C. Perennial--Lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

VI. Classification of weeds by difficulty of control

   A. Common weeds--More abundant and most easily controlled

   B. Secondary noxious weeds--Intermediate to others

   C. Primary noxious weeds--Very persistent and difficult to control; mostly perennials

INFORMATION SHEET

VII. Parts of a simple leaf (Transparency #6)

- A. Blade
- B. Veins
- C. Petiole
- D. Stipules

VIII. Parts of a compound leaf (Transparency #7)

- A. Leaflet
- B. Veins
- C. Petiolule
- D. Rachis
- E. Petiole
- F. Stipules

IX. Types of compound leaves (Transparency #8)

- A. Pinnate
- B. Bipinnate
- C. Palmate
- D. Trifoliate

X. Types of leaf arrangement (Transparency #9)

- A. Alternate
- B. Opposite
- C. Whorled

XI. Types of leaf veination (Transparency #10)

- A. Parallel
- B. Pinnate
- C. Palmate
- D. Netted

INFORMATION SHEET

XII. Types of leaf margins (Transparency #11)

A. Entire—No teeth or lobes on margin

B. Serrate—Toothed with teeth directed forward

C. Incised—Toothed with sinuses deeper than teeth

D. Lobed—Margin cut in about one-half way to midrib; sinuses and tips of segments rounded

XIII. Types of leaf attachment to the stem (Transparency #12)

A. Petiolate—Leaf attached by a petiole

B. Sessile—Leaf without a petiole; blade attached to stem

C. Clasping—Sessile leaf with the lower edges of the blade partly surrounding the stem

D. Decurrent—Point of attachment extends downward on the stem

XIV. Parts of a stem (Transparency #13)

A. Node

B. Internode

C. Terminal bud

D. Lateral bud

E. Leaf scar

F. Vascular bundle scar

XV. Types of stem modifications

A. Above ground (Transparency #14)

1. Crown—Appears just above or just below the ground; corn and small grains are characteristic of this

2. Stolon—Runners that grow along top of soil surface; may take root at nodes on runner; white clover is example

3. Spur—Modified stem growth that appears laterally on branches of fruit trees and bears fruit

INFORMATION SHEET

B. Below ground (Transparency #15)

1. Rhizomes--Grow horizontally below soil surface; contain nodes from which new plants originate; examples are canadian thistle, field bind weed and quackgrass

2. Tubers--Enlarged fleshy parts of a rhizome; example is potato

3. Corms--Fleshy, short underground stems containing very few buds; example is timothy

4. Bulb--Short, disc-shaped stem surrounded by leaf-like scales; example is gladiolus

XVI. Parts of a complete flower (Transparency #16)

A. Stamen--Male part of the flower producing the pollen

1. Anther--Bears the pollen

2. Filament--Supports the anther

B. Pistil--Female part of the flower producing the egg

1. Stigma--Upper part of pistil that catches pollen

2. Style--Supports stigma

3. Ovary--Produces ovules which develop into seeds

C. Accessory Parts

1. Corolla--Petals of the flower

2. Calyx--Sepals of the flower

3. Pedicel--Stalk of an individual flower

XVII. Types of flowers

A. Complete--Has stamen, pistil, petals and sepals on same flower; common to dicots

B. Incomplete--Has stamen and pistil but petals and/or sepals are missing; common to monocots

C. Perfect--Has both stamens and pistils on the same flower

D. Imperfect--Has either stamens or pistils, but not both on the same flower

INFORMATION SHEET

E. Staminate--Has only male flower parts

F. Pistillate--Has only female flower parts

G. Monoecious--Staminate and pistallate flowers found on the same plant; corn

H. Dioecious--Staminate and pistallate flowers found on separate plants; cottonwood tree

XVIII. Types of inflorescence (Transparencies #17 and #18)

A. Spike--Flowers sessile along the main axis

B. Raceme--Flowers single on pedicels along the rachis

C. Panicle--Two or more flowers on each pedicel, arranged along rachis

D. Corymb--A raceme with lower pedicels elongated and rachis shortened

E. Umbel--Pedicel of each flower attaches to a common point

F. Compound umbel

G. Head--Dense cluster of flowers

H. Solitary--Flowers borne singly, not it clusters

XIX. Types of root systems (Transparency #19)

A. Tap root system

(Note: In this sytem, one root is larger than the rest. Examples include alfalfa, sugar beets, beans, carrots, and radishes.)

B. Fibrous root system

(Note: In this sytem, all roots are approximately the same size. Examples include all the grasses and cereal grains.)

XX. Major Plant Families

A. Gramineae (grass family)

1. Wild oats

2. Annual bluegrass

3. Barnyard grass

INFORMATION SHEET

4. Green foxtail
5. Foxtail barley
6. Quackgrass
7. Wheat
8. Corn
9. Barley
10. Oats

B. Compositae (sunflower family)

1. Bull thistle
2. Meadow salsify
3. Common yarrow
4. Common groundsel
5. Dandelion
6. Chicory
7. Canada thistle
8. Prickly lettuce
9. Annual sowthistle
10. Mayweed
11. Spotted knapweed

C. Chenopodiaceae (lambsquarter family)

1. Russian thistle
2. Kochia
3. Lambsquarter

D. Solanaceae (potato family)

1. Longleaf groundcherry
2. Hairy nightshade

INFORMATION SHEET

3. Cutleaf nightshade
4. Potato
5. Tomato

E. Polygonaceae (buckwheat family)

1. Curly dock
2. Prostrate knotweed
3. Wild buckwheat
4. Rhubarb

F. Plantaginaceae (plantain family)

1. Buckhorn plantain
2. Broadleaf plantain

XXI. Weed competition with crops

A. Competition for water

B. Competition for nutrients

C. Competition for light

(Note: Crops and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XXII. Losses caused by weeds

(Note: Losses from weeds exceed losses by any other agricultural pest. One estimate put the total loss from weeds in the U.S. at $15 billion per year, or $6000 per year per farm.)

A. Decreased crop yields

B. Decreased crop quality

C. Cost of control activities

XXIII. How weeds spread

A. Wind

B. Flowing water

INFORMATION SHEET

C. Animals and manure

D. Impure seed

E. Farm machinery, cars, pickups and trucks

F. Earth moving equipment

G. Wild flower pickers

XXIV. General categories of weed control

A. Prevention--Practices to prevent the establishment of specific weed species in areas not currently infested

(Note: An ounce of prevention is worth a pound of cure.)

B. Eradication--Complete elimination of a given weed species so that it will not reappear in a given area

C. Control--Practices where weed populations are kept at a level that does not seriously interfere with crop production or yield

XXV. Methods of cultural control

A. Weed-free crop seed--Planting only crop seeds that have been cleaned to remove weed seeds

B. Smother crops--Crops that are highly competitive with weed species for light, nutrients, and water

(Note: Examples are small grains, grasses, and alfalfa.)

C. Crop rotation--Prevent or reduce the build up of certain weeds common to a particular crop

XXVI. Methods of mechanical control

A. Hand pulling--Best adapted to small areas for control of annual and biennial weeds

B. Hoeing--Best adapted for small areas for control of annual, biennial, and perennial weed seedlings

C. Mowing--Prevent seed production and restrict rank weed growth

D. Cultivation--Kill weeds by cutting off tops, burying or removing from soil

E. Mulching--Smother plants to cut off sunlight

F. Burning

INFORMATION SHEET

XXVII. Classification of herbicides

A. Herbicide selectivity

1. Selective--Used to kill weeds without significant damage to crop

2. Non-selective--Kill all plants present if applied at an adequate rate

B. Mode of herbicide action

1. Contact--Kills only part of plant to which it is applied; not translocated

2. Systemic--Absorbed by roots or foliage and translocated throughout plant

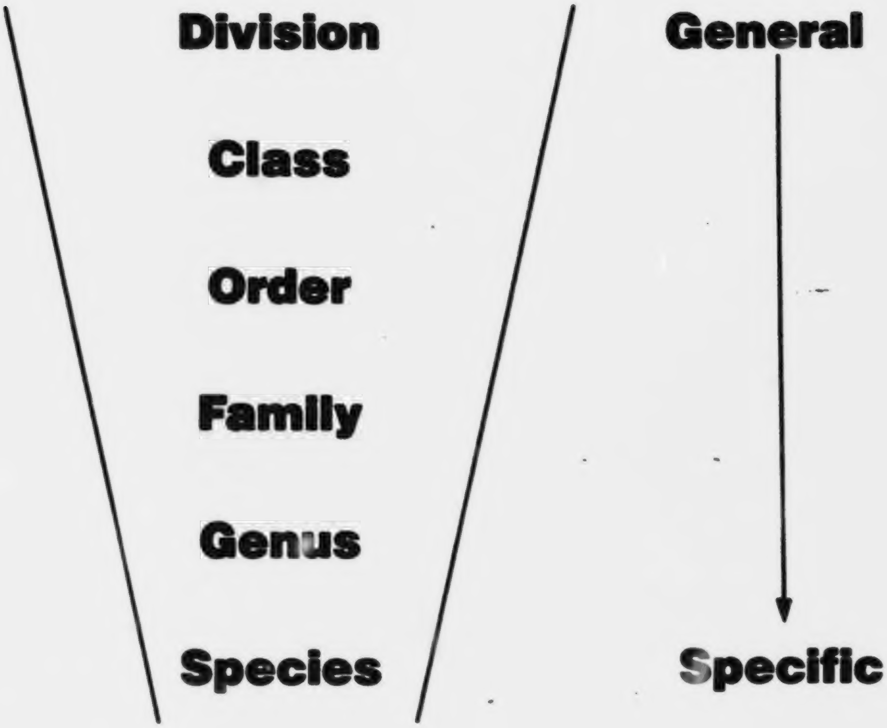
C. Time of application

1. Preplant--Applied to soil before crop is planted

2. Preemergence--Applied prior to emergence but after crop planting

3. Postemergence--Applied after emergence of the crops or weeds

Binomial System of Plant Classification



Division

Class

Order

Family

Genus

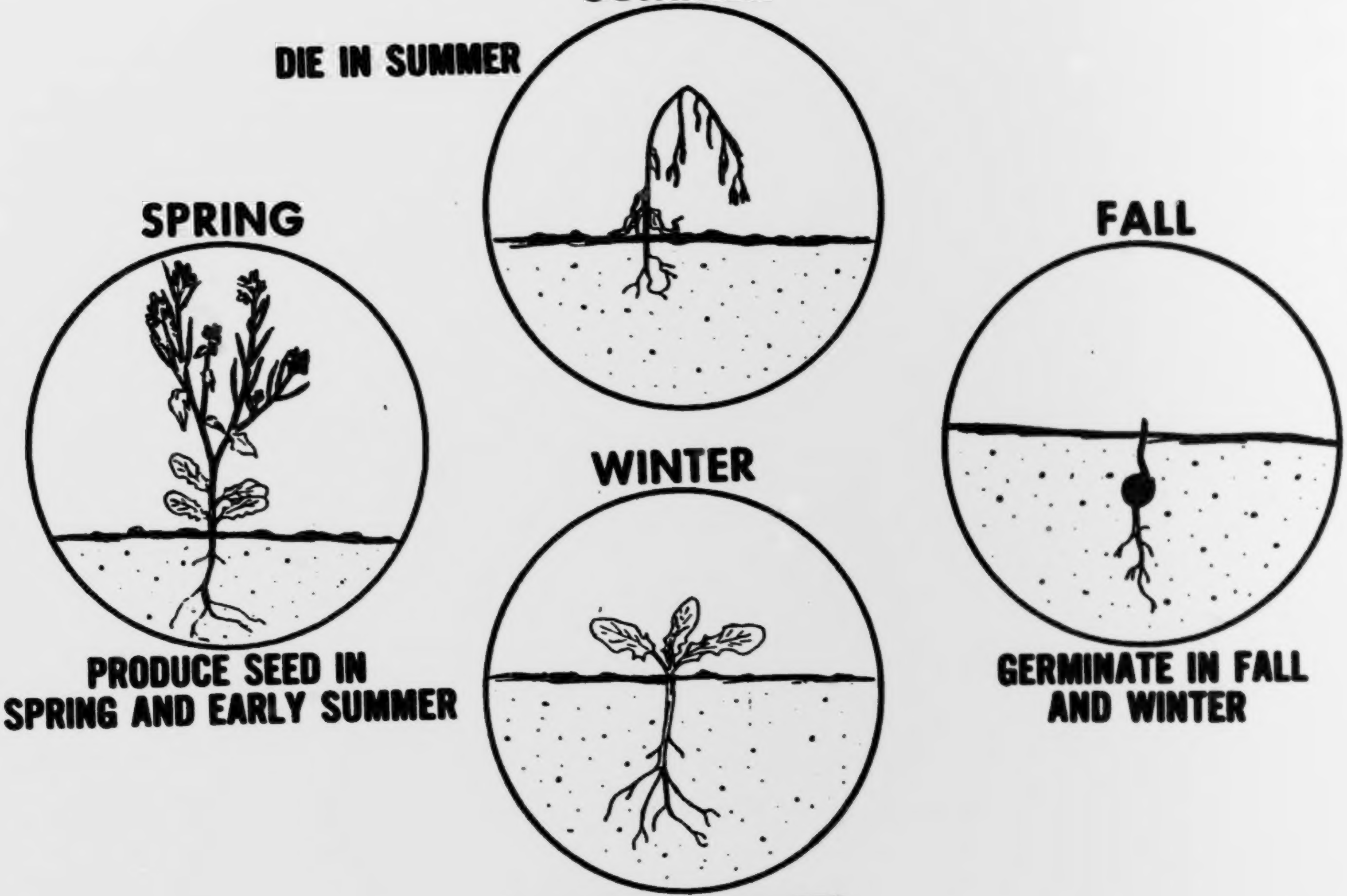
Species

General

Specific

TM #1

WINTER ANNUALS



SUMMER

DIE IN SUMMER

SPRING

PRODUCE SEED IN SPRING AND EARLY SUMMER

FALL

GERMINATE IN FALL AND WINTER

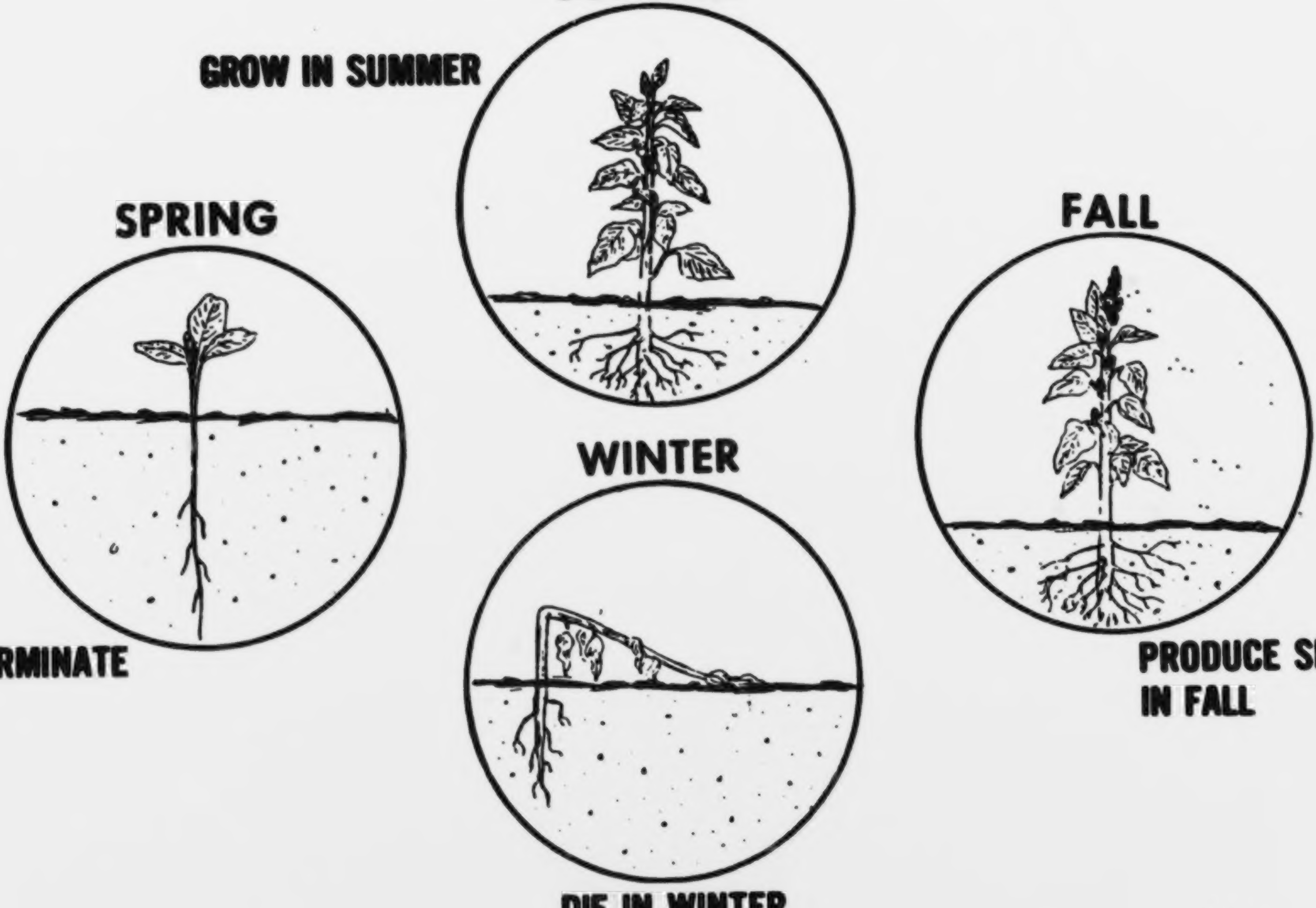
WINTER

DORMANT IN WINTER

TM #2

CSS 10 20

SUMMER ANNUALS



SPRING

GERMINATE

SUMMER

GROW IN SUMMER

FALL

PRODUCE SEED IN FALL

WINTER

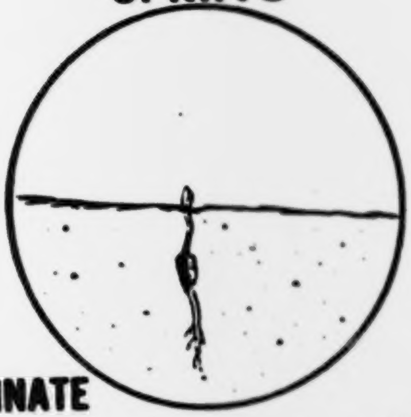
DIE IN WINTER

TM #3

CSS 10 21

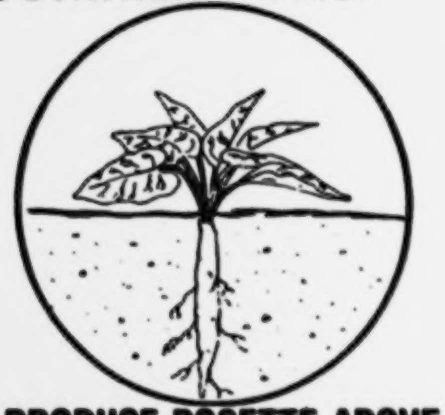
BIENNIALS

SPRING



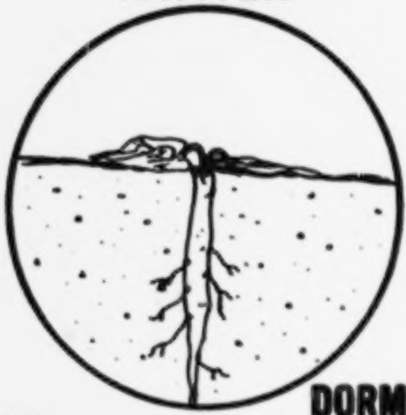
GERMINATE

SUMMER FALL



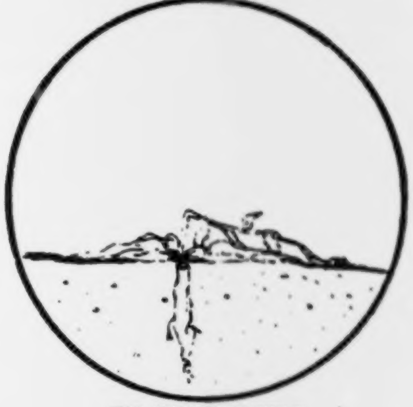
PRODUCE ROSETTE ABOVE
GROUND AND WELL DEVELOPED ROOT

WINTER



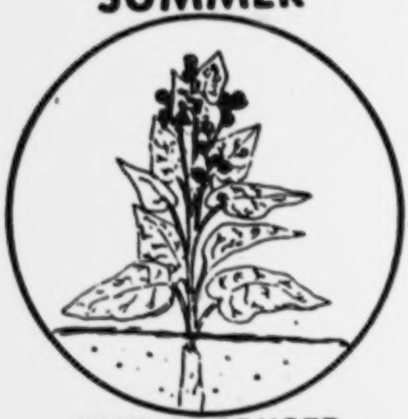
DORMANT

WINTER



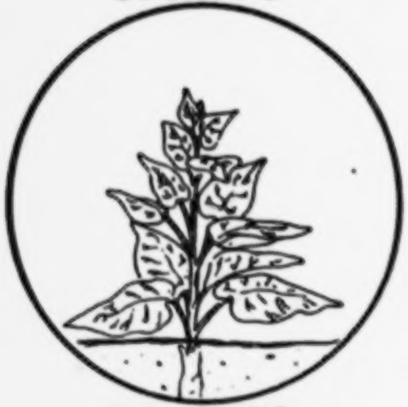
PLANT DIES

SUMMER



SEED PRODUCED

SPRING

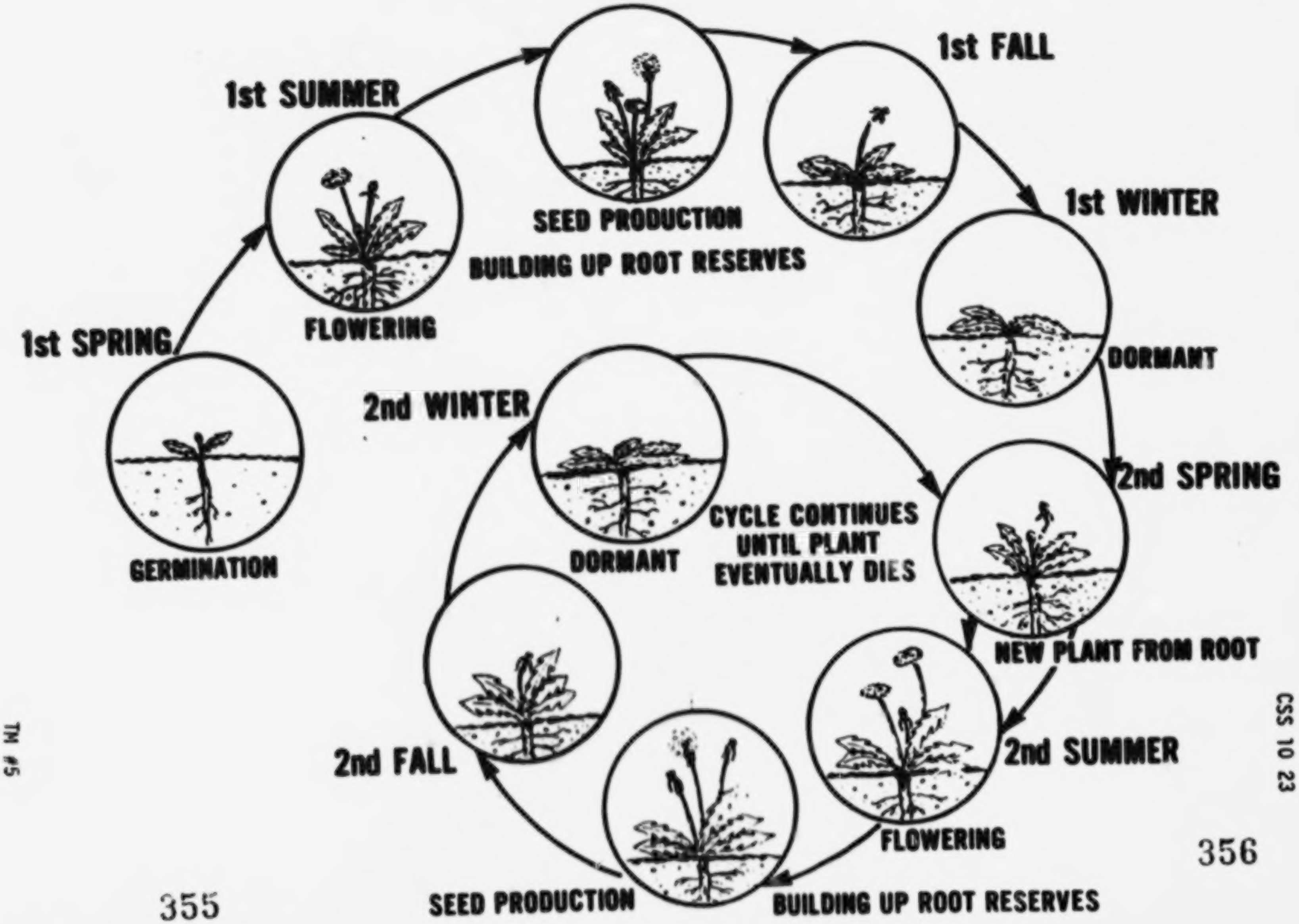


FLOWERING
STALK STARTS

TM #4

CSS 10 22

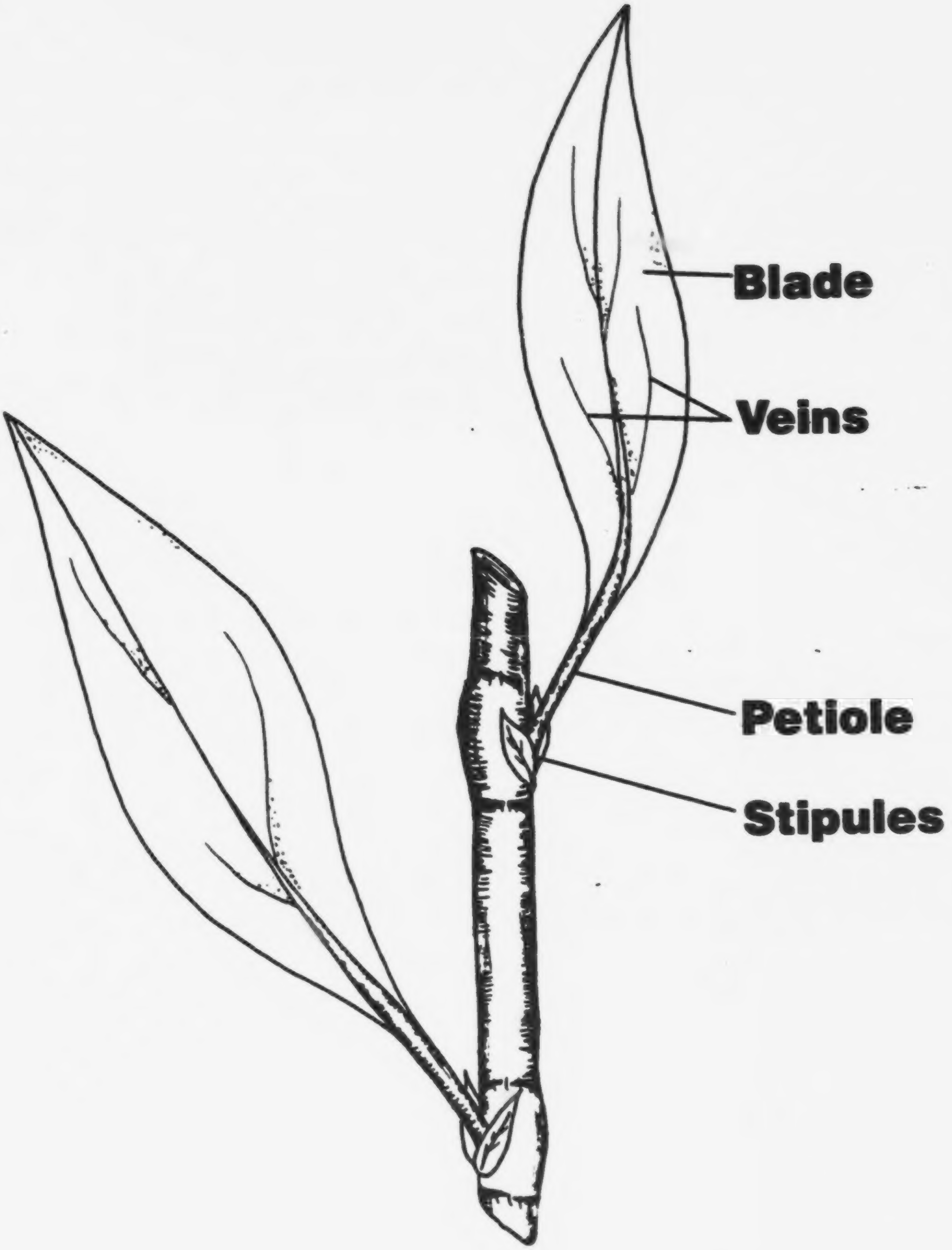
PERENNIALS


1st SPRING
GERMINATION
1st SUMMER
FLOWERING
SEED PRODUCTION
BUILDING UP ROOT RESERVES
1st FALL
1st WINTER
DORMANT
2nd SPRING
NEW PLANT FROM ROOT
2nd SUMMER
FLOWERING
BUILDING UP ROOT RESERVES
SEED PRODUCTION
2nd FALL
2nd WINTER
DORMANT
CYCLE CONTINUES
UNTIL PLANT
EVENTUALLY DIES

TM #5

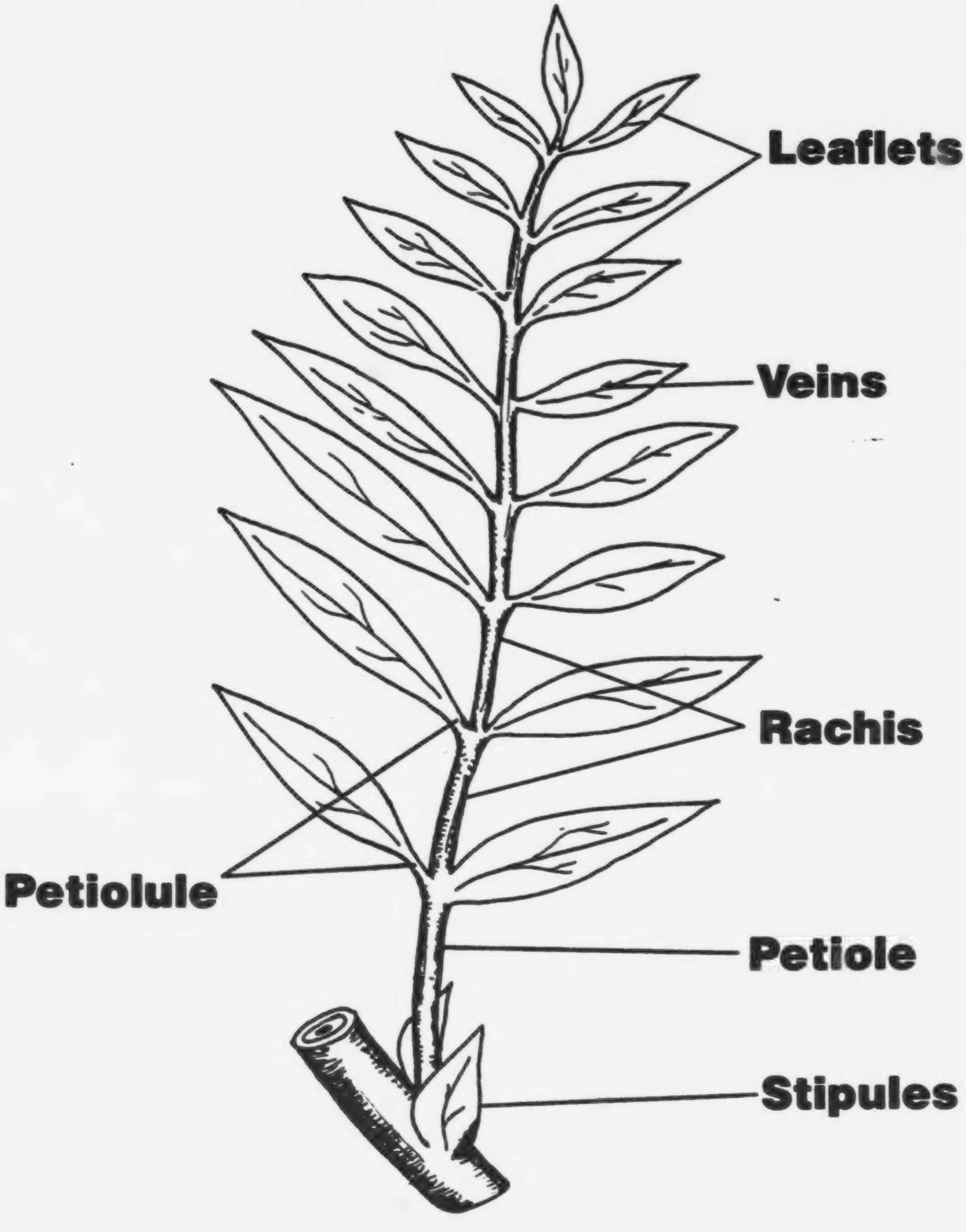
CSS 10 23

Parts of a Simple Leaf


Blade
Veins
Petiole
Stipules

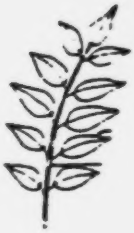
TM #6

Parts of a Compound Leaf

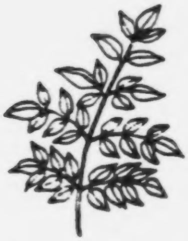

Leaflets
Veins
Rachis
Petiolule
Petiole
Stipules

TM #7

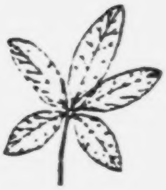
Types of Compound Leaves



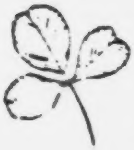
Pinnate



Bipinnate

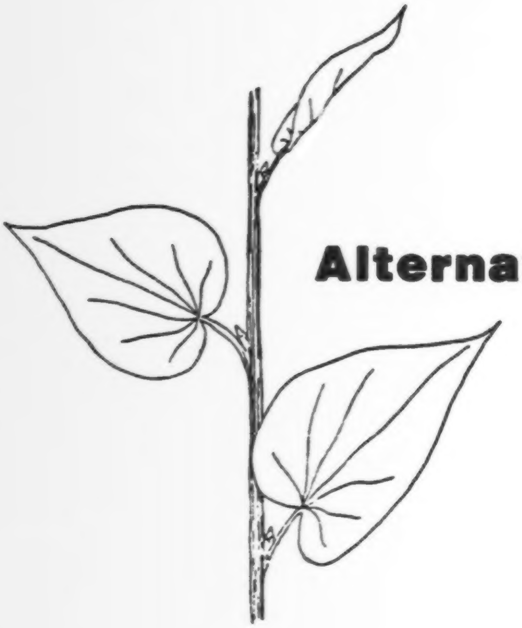


Palmate

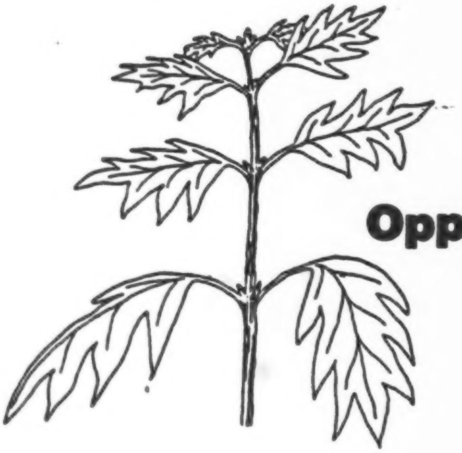


Trifoliate

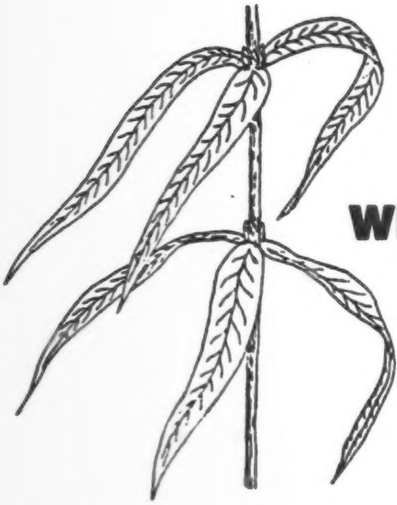
Types of Leaf Arrangement



Alternate



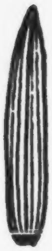
Opposite

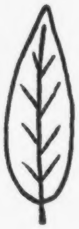


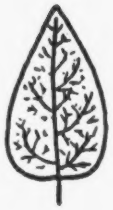
Whorled

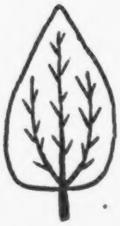
CSS 10 28

Types of Leaf Veination





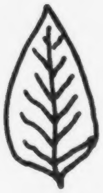


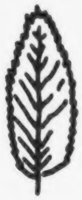


TM #10

Types of Leaf Margins

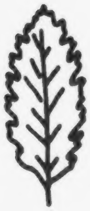
Entire

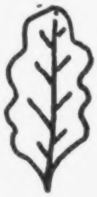




Serrate

Incised



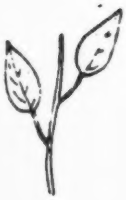


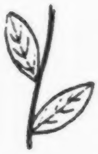
Lobed

TM #11

Types of Leaf Attachment

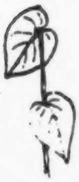
Petiolate

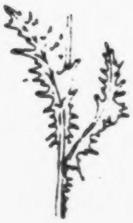




Sessile

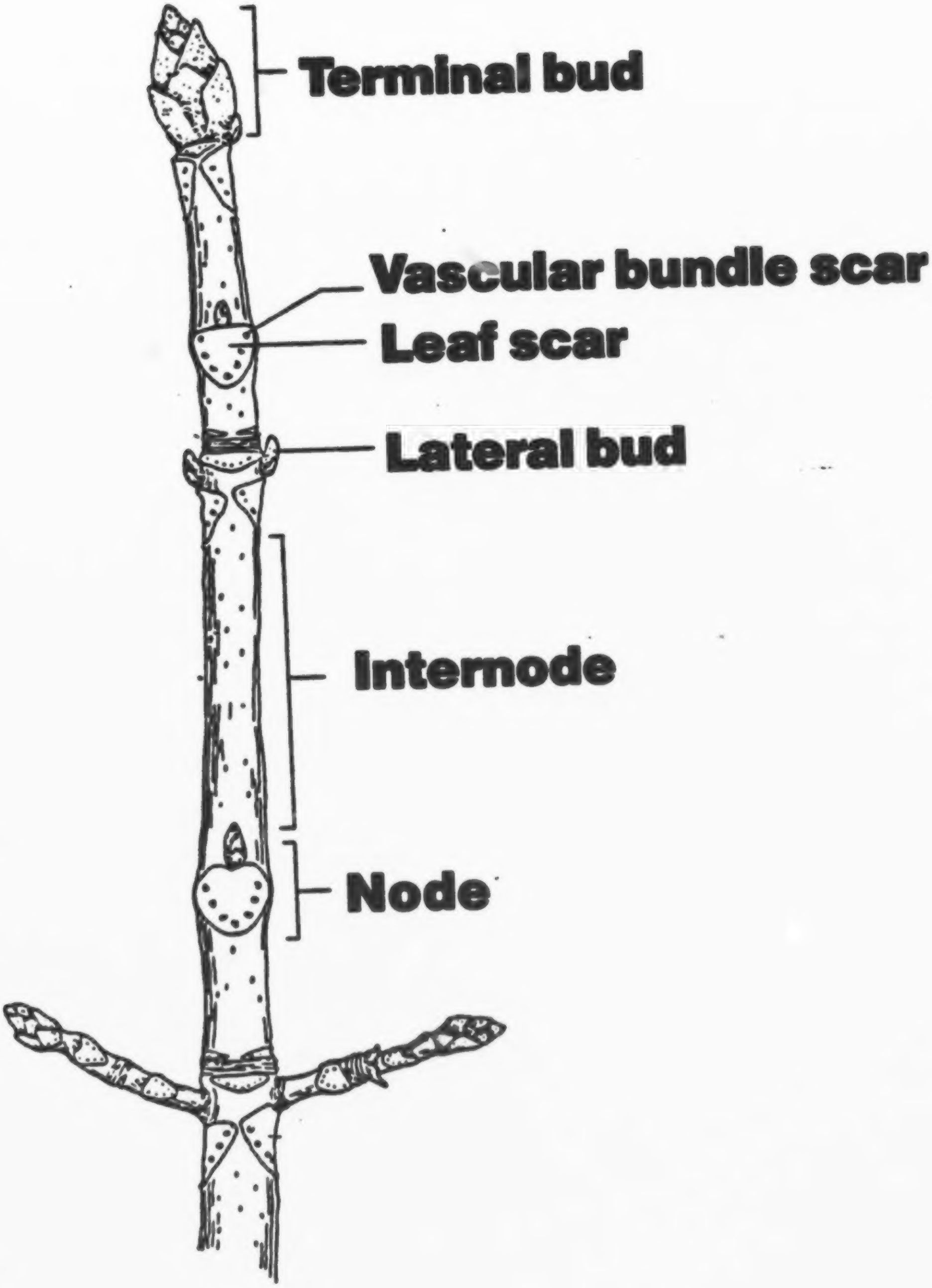
Clasping



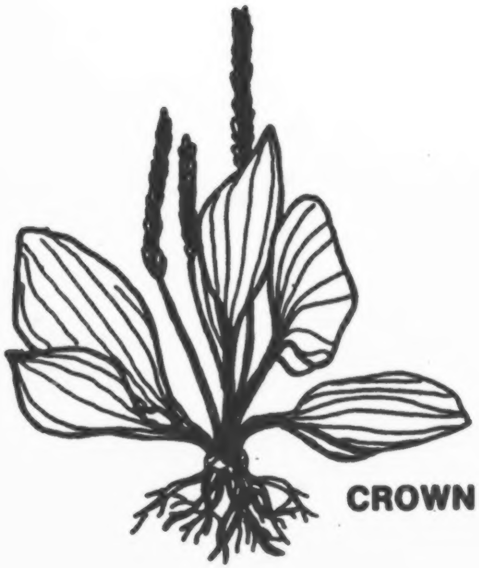


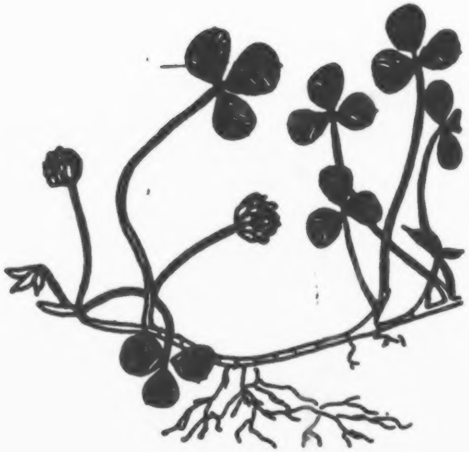
Decurrent

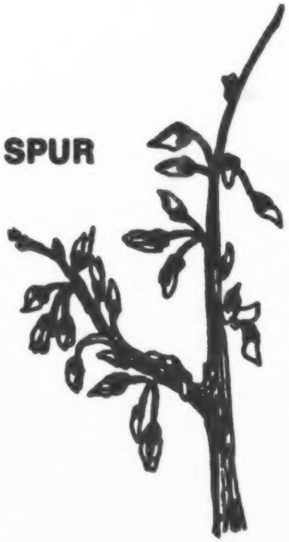
Parts of the Stem


Terminal bud
Vascular bundle scar
Leaf scar
Lateral bud
Internode
Node

ABOVEGROUND STEM MODIFICATIONS



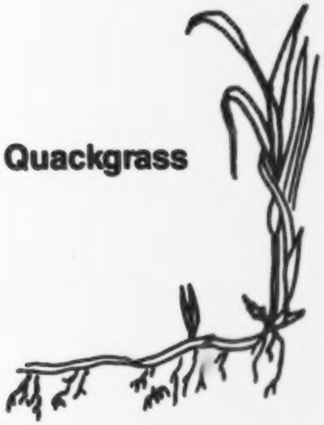




TM #14

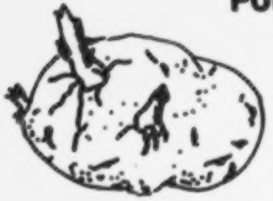
CSS 10 32

Below Ground Stem Modifications



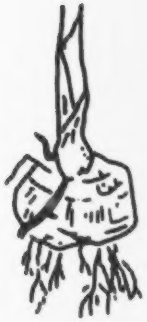
Quackgrass

Rhizomes



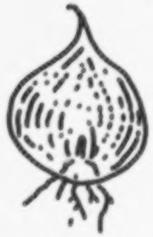
Potato

Tuber



Gladiolus

Corm



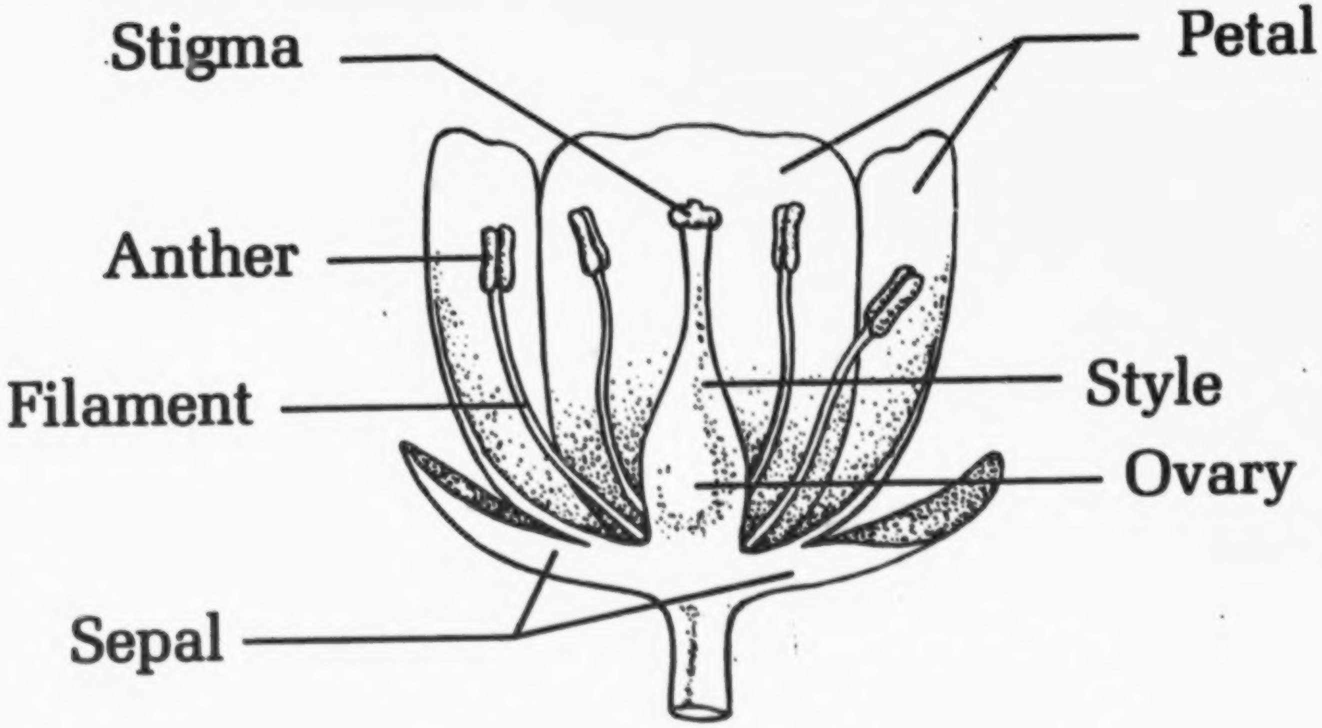
Onion

Bulbs

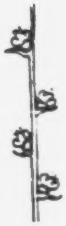
TM #15

CSS 10 33

Parts of a Complete Flower

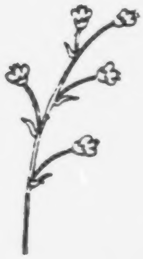

Stigma
Petal
Anther
Filament
Style
Ovary
Sepal

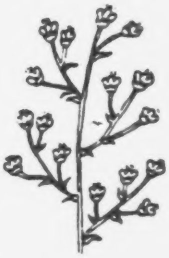
Types of Inflorescence



Spike

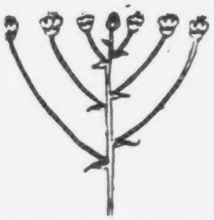
Raceme





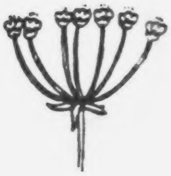
Panicle

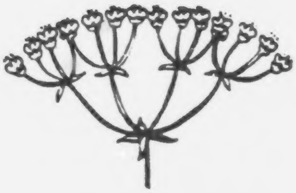
Corymb



Types of Inflorescence (Continued)

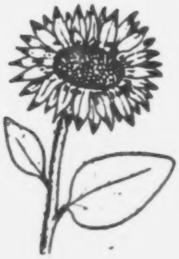
Umbel

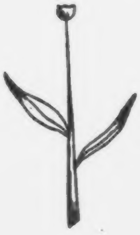




Compound Umbel

Head

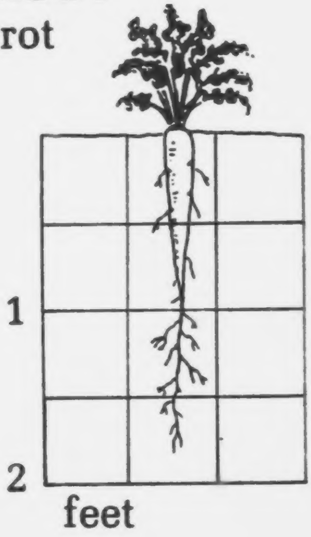




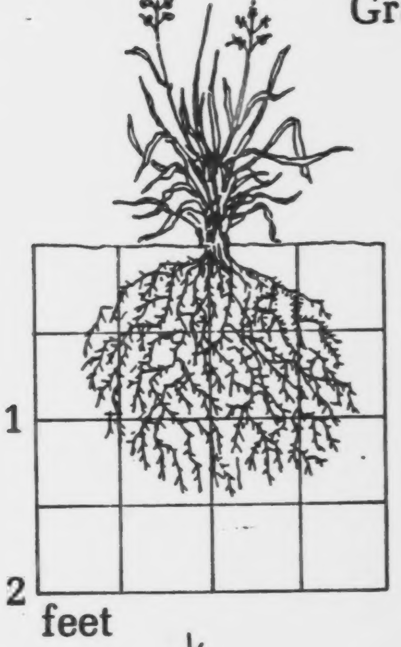
Solitary

Types of Root Systems

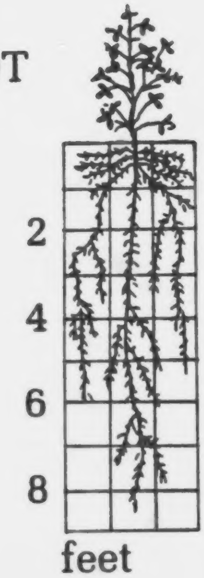
TAPROOT
Carrot



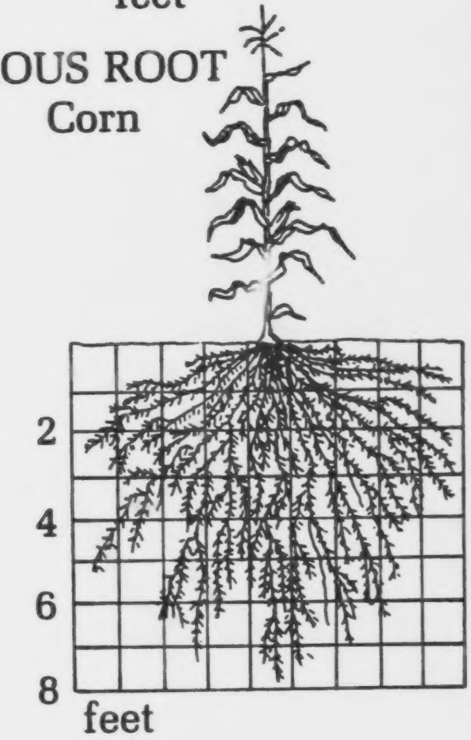
FIBROUS ROOT
Grass



TAPROOT
Alfalfa



FIBROUS ROOT
Corn



CROP AND WEED IDENTIFICATION
UNIT 10

TEST

NAME____ SCORE_______________

1. Match terms associated with crop and weed identification to the correct definitions. Write the correct numbers in the blanks.

1. Weed
2. Noxious weed
3. Schrub
4. Herb
5. Vine
6. Tree
7. Rosette
8. Prostrate
9. Evergreen
10. Deciduous
11. Alternate
12. Opposite
13. Simple leaf
14. Compound leaf
15. Midrib
16. Vein
17. Blade
18. Petiole
19. Pinnate
20. Internode
21. Node

_____a. The part of a stem between two nodes

_____b. Not opposite; one leaf at a node

_____c. A plant with no persistent woody stem above ground

_____d. Any plant that interferes with human affairs

_____e. The expanded usually flat portion of a leaf

_____f. The main or central rib of a leaf

_____g. Lying flat on the ground

_____h. A plant climbing on some support, the stem not standing upright by itself

_____i. A leaf completely separated into two or more leaflets

_____j. Leaves two at a node and situated across the stem from each other

_____k. A perennial woody plant of considerable stature at maturity with one or few main trunks

_____l. Compound leaf with the leaflets on opposite sides

_____m. Place on a stem where leaves are attached

_____n. Any plant which is determined by a state agency to be injurious to public health, crops, livestock, land or other property

_____o. A dense basal cluster of leaves arranged in a circular fashion

_____p. Of only one part; leaf not completely divided into separate segments

TEST

_____q. The stalk of a leaf blade

_____r. Bearing green leaves throughout the year

_____s. A woody perennial plant smaller than a tree

_____t. Plants that shed their leaves annually

_____v. Threads of vascular tissue in a leaf

2. Discuss why we need to identify plants

____

____

____

____

____

____

3. Select from the following list reasons plant identification can not be made easy. Write an "X" in the blank before each correct answer.

_____a. Microscopic detail is often necessary

_____b. Constant practice is necessary

_____c. Descriptive terms must be mastered

_____d. Plants to identify are difficult to obtain

_____e. Information on plant identification not available

_____f. Most plants look alike

4. Arrange in order the binomial system of plant classification. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Order

_____b. Species

_____c. Class

_____d. Genus

_____e. Division

_____f. Family

TEST

5. Name three classifications of plants by life cycle.

a. ______________________________

b. ______________________________

c. ______________________________

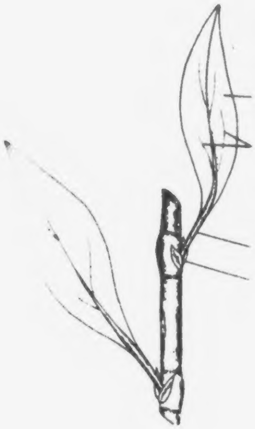
6. Name three classifications of plants by difficulty of control.

a. ______________________________

b. ______________________________

c. ______________________________

7. Label the parts of a simple leaf. Write the correct names in the blanks.



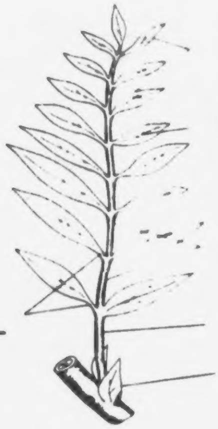
d. ____________________

c. ____________________

b. ____________________

a. ____________________

8. Label the parts of a compound leaf. Write the correct names in the blanks.



a. ____________________

b. ____________________

c. ____________________

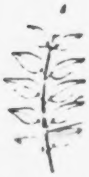
d. ____________________

e. ____________________

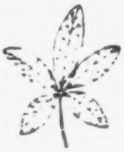
f. ____________________

TEST

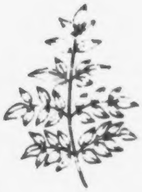
9. Identify types of compound leaves. Write the correct names in the blanks.



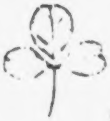
a. ______________________



c. ______________________



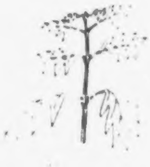
b. ______________________



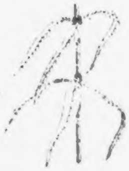
d. ______________________

10. Identify types of leaf arrangement. Write the correct names in the blanks.

a. ______________________



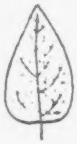
b. ______________________



c. ______________________

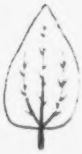
. Identify types of leaf veination. Write the correct names in the blanks.

a. ______________________



c. ______________________

b. ______________________



d. ______________________

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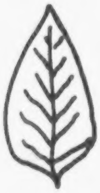
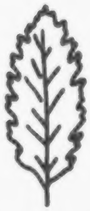
TEST

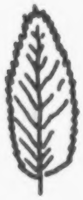
12. Identify types of leaf margins. Write the correct names in the blanks.



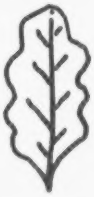
a. ____________________



c. ____________________

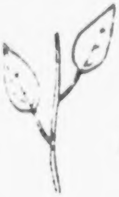


b. ____________________

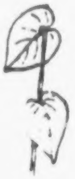


d. ____________________

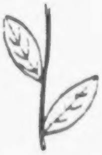
13. Identify types of leaf attachment to the stem. Write the correct names in the blanks.



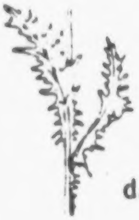
a. ____________________



c. ____________________

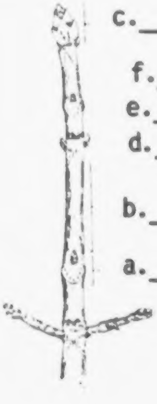


b. ____________________



d. ____________________

14. Label the parts of a stem. Write the correct names in the blanks.



c. ____________________

f. ____________________

e. ____________________

d. ____________________

b. ____________________

a. ____________________

TEST

15. Match stem modifications to the correct description. Write the correct numbers in the blanks.

1. Crown
2. Stolon
3. Spur
4. Rhizome
5. Tuber
6. Corm
7. Bulb

_____a. Enlarged fleshy part found at the tip of a rhizome; potato

_____b. Appears laterally on branches of fruit trees and bears fruit; apple

_____c. Short, disc-shaped stem surrounded by leaf-like scales; onion

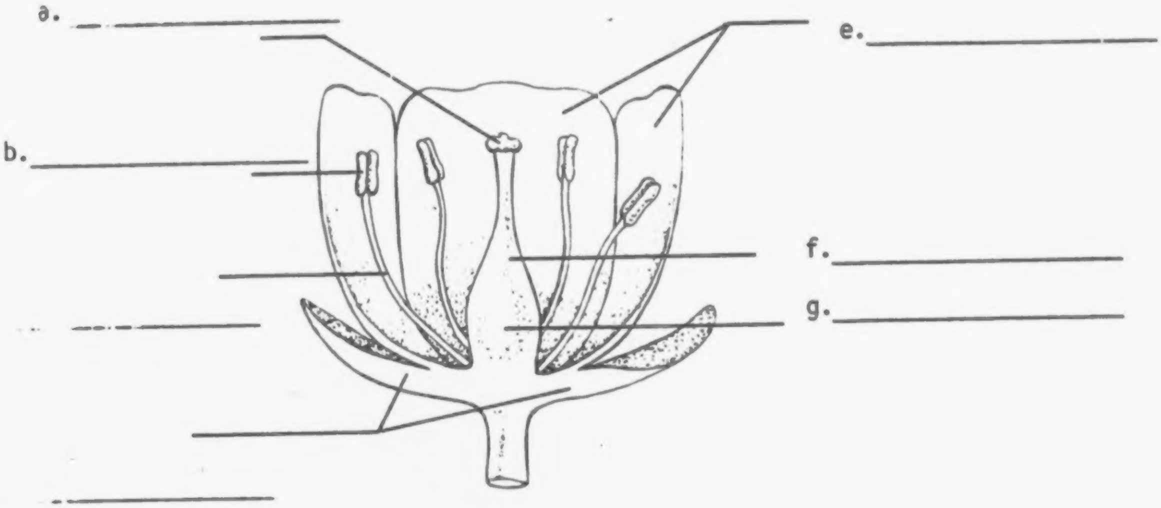
_____d. Fleshy, short underground stem with very few buds; gladiolus

_____e. Runners that grow along top of soil surface; strawberry

_____f. Underground stems that grow horizontally below soil surface; quackgrass

_____g. Appears just above or just below ground level from which modified stems grow; small grains

16. Label the parts of a complete flower. Write the correct names in the blanks.



TEST

17. Match the type of flower to the correct description. Write the correct numbers in the blanks.

1. Complete	5. Staminate
2. Incomplete	6. Pistillate
3. Perfect	7. Monoecious
4. Imperfect	8. Dioecious

_____a. Staminate and pistillate flowers found on the same plant; corn

_____b. Has both stamens and pistils on the same flower

_____c. Has only male flower parts

_____d. Has stamen, pistil, petals, and sepals on the same flower; common to dicots

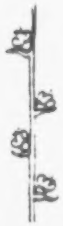
_____e. Has only female flower parts

_____f. Has either stamens or pistils, but not both on the same flower

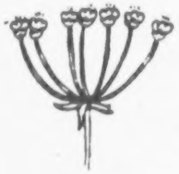
_____g. Has stamen and pistil but petals and/or sepals are missing; common to monocots

_____h. Staminate and pistillate flowers found on separate plants; cottonwood tree

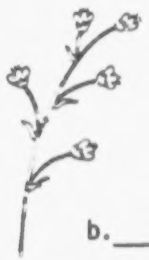
18. Identify types of inflorescence. Write the correct names in the blanks.



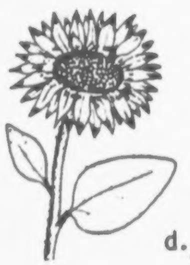
a.____________________



c.____________________



b.____________________



d.____________________

19. Name two types of root systems.

a.____

b.____

TEST

20. Select the correct plant family when given the common name of the plant. Write the correct numbers in the blanks.

1. Graminae	4. Solanaceae
2. Compositae	5. Polygonaceae
3. Chenopodiaceae	6. Plantaginaceae

_____a. Potato

_____b. Canada thistle

_____c. Wild oats

_____d. Lambsquarter

_____e. Buckhorn plantain

_____f. Quackgrass

_____g. Prickly lettuce

_____h. Wheat

_____i. Hairy nightshade

_____j. Curly dock

21. Name three natural resources crops and weeds are in competition for.

a.____

b.____

c.____

22. Name three losses caused by weeds.

a.____

b.____

c.____

TEST

23. Select from the following list ways that weeds spread. Write and "X" in the blank before each correct answer.

_____a. Irrigation water

_____b. Livestock

_____c. Manure

_____d. Wildflower gatherers

_____e. Farm machinery

_____f. Wind

_____g. Fill soil

_____h. Planting of weed seed

24. Match the general categories of weed control to the correct description. Write the correct numbers in the blanks.

1. Prevention
2. Eradication
3. Control

_____a. Complete elimination of a given weed species so that it will not reappear in a given area

_____b. Practices where weed populations are kept at a level that does not seriously interfere with crop production or yield

_____c. Practices to prevent the establishment of specific weed species in an area not currently infested

25. Select from the following list methods of cultural weed control. Write an "X" in the blank before each correct answer.

_____a. Cultivation

_____b. Crop rotation

_____c. Burning

_____d. Smother crops

_____e. Use of selective herbicide

_____f. Use of weed-free crop seed

TEST

26. Select from the following list methods of mechanical weed control. Write an "X" in the blank before each correct answer.

_____a. Crop rotation

_____b. Discing

_____c. Burning

_____d. Use of contact herbicide

____e. Use of weed-free crop seed

____f. Mowing

____g. Mulching

____h. Hoeing

27. Match the classifications of herbicides to the correct description. Write the correct numbers in the blanks.

1. Selective
2. Non-selective
3. Contact
4. Systemic
5. Preplant
6. Preemergence
7. Postemergence

_____a. Kills only part of plant to which it is applied; not translocated

_____b. Applied to soil before crop is planted

_____c. Absorbed by roots or foliage and translocated throughout plant

_____d. Kills all plants present if applied at an adequate rate

_____e. Applied after emergence of the crops or weeds

_____f. Applied prior to emergence but after crop planting

_____g. Used to kill weeds without significant damage to crop

CROP AND WEED IDENTIFICATION
UNIT 10

ANSWERS TO TEST

1. a. 20
   b. 11
   c. 4
   d. 1
   e. 17
   f. 15
   g. 8
   h. 5
   i. 14
   j. 12
   k. 6
   l. 19
   m. 21
   n. 2
   o. 7
   p. 13
   q. 18
   r. 9
   s. 3
   t. 10
   u. 16

2. Evaluated to satisfaction of instructor

3. a, b, c

4. a. 3 b. 6 c. 2 d. 5 e. 1 f. 4

5. a. Annual b. Biennial c. Perennial
6. a. Common b. Secondary noxious c. Primary noxious

7. a. Stipules b. Petiole c. Veins d. Blade

8. a. Leaflets
   b. Veins
   c. Rachis
   d. Petiolule
   e. Petiole
   f. Stipules

9. a. Pinnate
   b. Bipinnate
   c. Palmate
   d. Trifoliate

10. a. Alternate b. Opposite c. Whorled

11. a. Parallel
    b. Pinnate
    c. Netted
    d. Palmate

12. a. Entire
    b. Serrate
    c. Incised
    d. Lobed

13. a. Petiolate
    b. Sessile
    c. Clasping
    d. Decurrent

14. a. Node
    b. Internode
    c. Terminal bud
    d. Lateral bud
    e. Leaf scar
    f. Vascular bundle scar

15. a. 5
    b. 3
    c. 7
    d. 6
    e. 2
    f. 4
    g. 1

16. a. Stigma
    b. Anther
    c. Filament
    d. Sepal
    e. Petal
    f. Style
    g. Ovary

ANSWERS TO TEST

17. a. 7
b. 3
c. 5
d. 1
e. 6
f. 4
g. 2
h. 8

18. a. Spike
b. Raceme
c. Umbel
d. Head

19. a. Tap root system
b. Fibrous root system

20. a. 4
b. 2
c. 1
d. 3
e. 6
f. 1
g. 2
h. 1
i. 4
j. 5

21. a. Water
b. Nutrients
c. Light

22. a. Decreased crop yields
b. Decreased crop quality
c. Cost of control activities

23. a, b, c, d, e, f, g, h

24. a. 2
b. 3
c. 1

25. b, d, f

26. b, c, f, g, h

27. a. 3
b. 5
c. 4
d. 2
3. 7
f. 6
g. 1

INSECT PESTS OF CROPS
UNIT 11

UNIT OBJECTIVE

After completion of this unit, the student should be able to list ways that insects cause losses to crops as well as their beneficial effects. The student should also be able to identify the body regions of an insect, and classify insects according to feeding habits. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with insect pests of crops to the correct definition.
2. Name three ways insects cause losses to crops.
3. Select from a list beneficial effects of insects.
4. Discuss the economic importance of insect control.
5. Label a drawing showing the body regions of an insect.
6. Name two characteristics which aid in distinguishing one insect from another.
7. Name three identifying characteristics of mites, ticks, and spiders.
8. Match the insect feeding habit to the correct description.
9. Label a drawing showing the three and four stage life cycles of insects.
10. Select from a list cultural control practices for insects.
11. Select from a list biological control practices for insects.
12. Select from a list chemical control practices for insects.
13. Match classifications of insecticides to the correct description.

INSECT PESTS OF CROPS
UNIT 11

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. Insect Pests of Field Crops and Stored Grains, manual; available from Ohio Agriculture Education Curriculum Materials Center, Ohio State University, Columbus, OH, 43210; approximate cost $4.00, order no. 1016M.

      b. Insect Pest Identification of Corn, Soybeans and Alfalfa, 50-page manual; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland, Urbana, IL, 61801; approximate cost $3.50.

      c. Insect Identification Manual; available from VEP, Cal Poly State University, San Luis Obispo, CA, 93407; approximate cost $8.25.

    2. Filmstrips, slideshows, etc.

      a. Identification and Control of Common Crop Insects, 49 slides and cassette; available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approximate cost $62.40, order no. D12.

      b. Identifying Common Insect Pests, filmstrip or slide set, cassette and study guide; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland, Urbana, IL, 61801

    3. Films

  B. Make transparencies

  C. Provide students with objective sheet

  D. Provide students with information sheet

  E. Discuss unit and specific objectives

SUGGESTED ACTIVITIES

F. Discuss information sheet

G. Give test

H. Reteach if necessary

I. Retest

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Insects cause losses to crops
2. TM 2--Insect damage
3. TM 3--Adult insects
4. TM 4--Wings and mouthparts
5. TM 5--Mite, tick and spider
6. TM 6--Insect classification by feeding habit
7. TM 7--Four stage life cycle
8. TM 8--Three stage life cycle

E. Test

F. Answers to test

III. Unit references

A. Romoser. W.S. The Science of Entomology. New York, N.Y. Macmillan Publishing Col, Inc.: 1973.

B. Westcott, C. The Gardener's Bug Book, 3rd edition. Garden City, N.Y. Doubleday and Company, Inc.: 1964.

C. Homan, H.W., et al. Insects Affecting Idaho Agriculture. Moscow, ID. University of Idaho: 1982.

D. Hughes, H.A. Crop Chemicals, 2nd edition. Moline, Illinois. John Deere Technical Services: 1982.

E. Insect and Disease Control. College Station, Texas. Teaching Materials Center, Agriculture Education Department, Texas A & M University: Vo-Ag II, Unit IV-D.

INSECT PESTS OF CROPS
UNIT 11

INFORMATION SHEET

I. Terms and definitions

A. Insect--Small, boneless animal whose body is divided into three sections and has six legs

B. Spider--A small, eight-legged animal having a body composed of two division (cephalothorax and abdomen); the spider is an arachnid, not an insect

C. Mite--Any of a large number of tiny arachnids, many of which live as parasites upon plants

D. Entomology--A branch of science that deals with the study of insects

E. Life cycle--Stages in the life development of an insect

F. Metamorphosis--A change in form, either gradual or sudden

G. Complete metamorphosis--Having four distinct growth stages in development in which a major change in structure and appearance of the insect occurs; each feeding life stage may eat different diets and occupy different environments

H. Incomplete metamorphosis--Gradual change in appearance as growth proceeds; the immature forms are called nymphs and eat the same as the adults

I. Larva--Immature form of an insect having complete metamorphosis

J. Pupa--Stage between the larva and adult in insects with complete metamorphosis

K. Cocoon--A silken case inside which the pupa is formed

L. Nymph--The immature stage of an insect with incomplete metamorphosis

M. Damage--Associated with crop loss and/or reduction in crop yield or crop quality

N. Injury--Deviation from normal appearance of the plant, from which it may recover, and not depress yield and/or quality

P. Pesticide--Chemical used to control pests

Q. Insecticide--A pesticide used to kill or control insects

R. Acaricide--Pesticide used to kill or control mites, ticks, and spiders

INFORMATION SHEET

II. Ways insects cause losses to crops (Transparency #1 and #2)

A. Reduce crop yield

B. Reduce quality of the crop

C. Cost of control practices

D. Transmit plant diseases

(Note: Insects may cause damage or injury depending on seriousness of infestation and the effectiveness of control measures.)

III. Beneficial effects of insects

A. Carry pollen for pollination which is essential to seed production of many crops.

B. Natural enemies which control pest insects

C. Production of useful products

1. Honey

2. Beeswax

3. Silk

IV. Economic importance of insect control

A. $1 billion spent annually on insect control

B. $5 billion estimated losses

C. Estimated 5% - 10% of total crop damaged

D. Over $100 million spent yearly on the cotton alone

V. Body regions of an insect (Transparency #3)

A. Head--Bears one pair of antennae and mouth parts

B. Thorax--Bears three pairs of legs and often bears wings

C. Abdomen--Has as many as eleven segments, but never bears legs

(Note: Characteristics common to all adult insects include six jointed legs and three body regions.)

INFORMATION SHEET

VI. Charactersitics which distinguish one insect from another (Transparency #4)

A. Wings

(Note: Some insects have no wings; others have two or four. The wings vary in shape, size, thickness, and structure.)

B. Mouthparts

(Note: Insects with chewing mouthparts have toothed jaws that bite and tear the food. Insects with piercing-sucking mouthparts have tube-like beaks which they force into a plant to suck out fluids.)

VII. Characteristics of mites, ticks, and spiders (Transparency #5)

A. Eight jointed legs

B. Two body regions

C. No wings

VIII. Insect classification by feeding habits (Transparency #6)

A. Chewing

(Note: These insects bite off, chew, and swallow plant parts. This results in ragged, deformed, or stunted plants that may be more susceptible to disease and may die due to excessive damage.)

1. Grasshopper
2. Armyworm
3. Potato beetle
4. Blister beetle

B. Sucking

(Note: These insects pierce the outer layer of the plant tissue with their "coke straw" beak and feed on the plant sap.)

1. Aphid
2. Leafhopper
3. Thrips
4. Hessian Fly
5. Greenbug

INFORMATION SHEET

C. Internal (borers and miners)

(Note: This group includes mostly chewing insects that enter the plant and feed from within.)

1. European corn borer
2. Cotton boll weevil larva
3. Wheat stem sawfly

D. Subterranean

(Note: This group includes both chewing and sucking insects which enter the plant below the soil surface.)

1. Corn rootworm
2. Wireworm

IX. Life cycles of insects

(Note: Because insects live inside a chitinous exoskeleton which cannot be expanded as they grow, they progress by a series of molts, splitting and casting off the old shell. Between the time the insect pulls free from its old covering and before the new form is solidified, there is a chance for expansion in size. There may be 3, 4, 5, or even 20 molts depending on the species. The adult insect never increases in size; growth is always in the immature life stage.)

A. Four stage group (complete metamorphosis) (Transparency #7)

(Note: Insects in this group include beetles, flies, moths, bees, and butterflies.)

1. Egg
2. Larva
3. Pupa
4. Adult

INFORMATION SHEET

B. Three stage group (incomplete metamorphosis) (Transparency #8)

(Note: Insects in this group include grasshoppers, aphids, termites, dragonflies, and mayflies.)

1. Egg
2. Nymph
3. Adult

X. Cultural control practices for insects

A. Crop rotation

B. Trap crops

(Note: Small plots of a host plant the insect favors near susceptible crop. After insects have been attracted to the "trap", they can be killed by burning or with an insecticide.)

C. Tillage

D. Residue management

(Note: Shredding and incorporating of crop residue helps eradicate plant-borne insects.)

E. Timing of operations

(Note: Proper timing of planting or harvesting operations can be used to control insect damage if the host plant is resistant or susceptible for a brief period or if the damaging stage of the insects life cycle is out of synchronization with the plant's development.)

F. Resistant varieties

(Note: This involves selection of plants less damaged by the insects and plants that are more vigorous so it is better able to resist insect attacks.)

XI. Biological control practices for insects

(Note: The use of natural enemies, i.e. predators, parasites and insect disease sometimes can be used to control a pest.)

A. Natural enemies to a particular insect

INFORMATION SHEET

XII. Chemical control practices for insects

(Note: Chemicals may be applied to seeds, growing plants, or soil. Effectiveness depends on the characteristics of the chemical, susceptibility of the insect, plus the timing and method of application.)

A. Poison the insects

B. Repel the insects from specific areas

C. Attract insects to a place where they can be killed

XIII. Classifications of insecticides

A. Fumigant poison--Enters the insect's body through the respiratory system in the form of a gas

B. Stomach poison--Eaten and digested by the insect

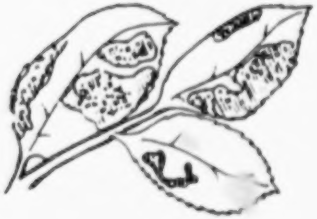
C. Contact poison--Absorbed through the insect's skin or body wall and acts upon the pests nervous system

Insects Cause Losses to Crops

Reduce Crop Yield

Reduce Quality of the Crop

Cost of Control Activities

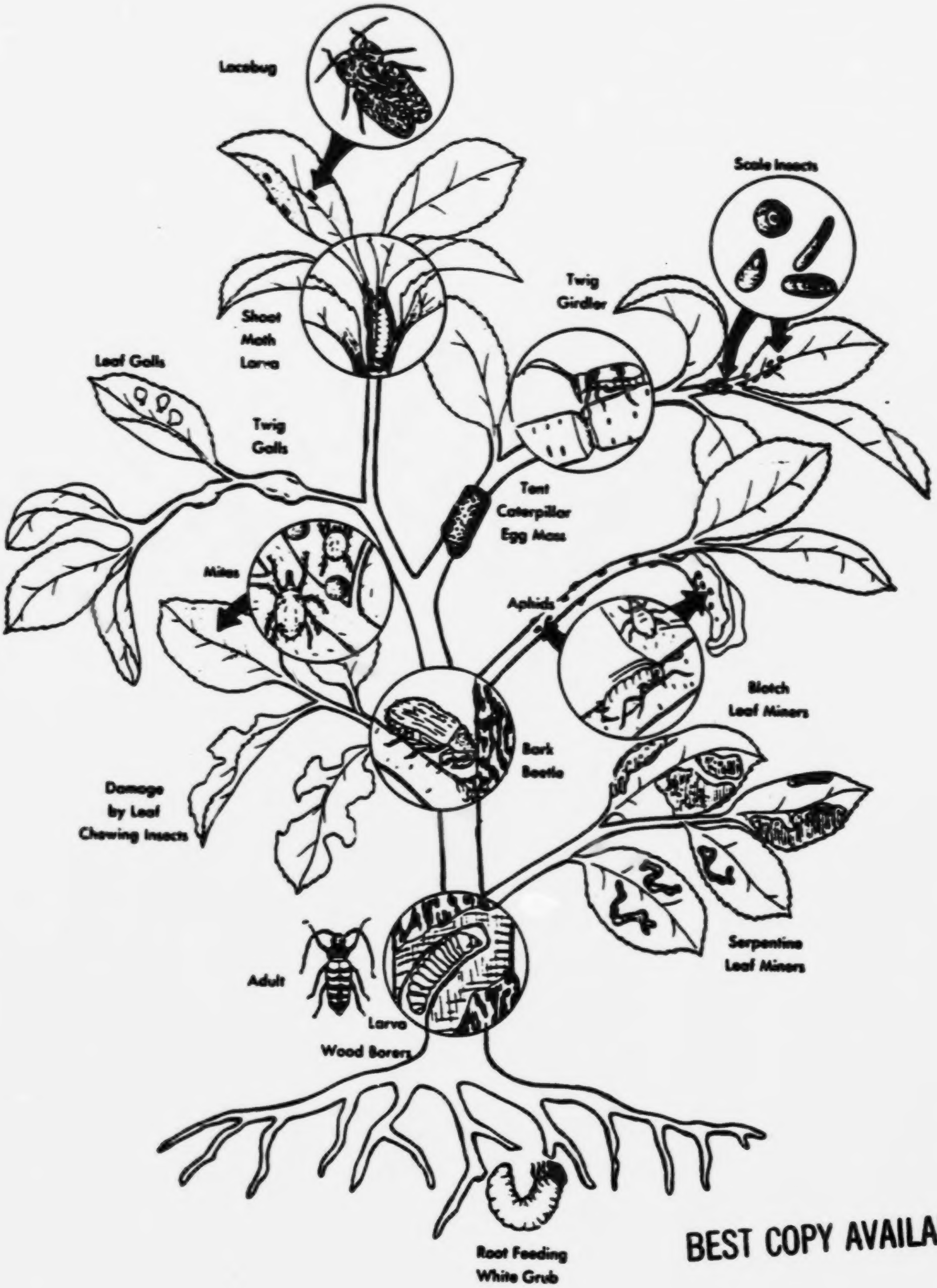


Transmit Plant Disease

TM #1

CSS 11 10

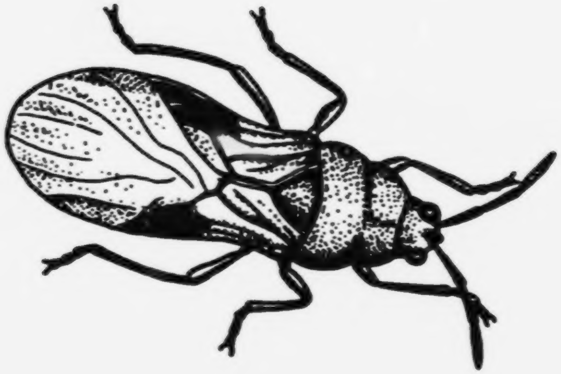
Insect Damage

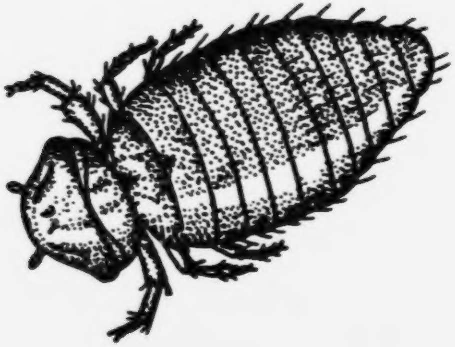

Lacebug
Scale Insects
Twig Girdler
Shoot Moth Larva
Leaf Galls
Twig Galls
Tent Caterpillar Egg Mass
Mites
Aphids
Blotch Leaf Miners
Bark Beetle
Damage by Leaf Chewing Insects
Serpentine Leaf Miners
Adult
Larva
Wood Borers
Root Feeding White Grub

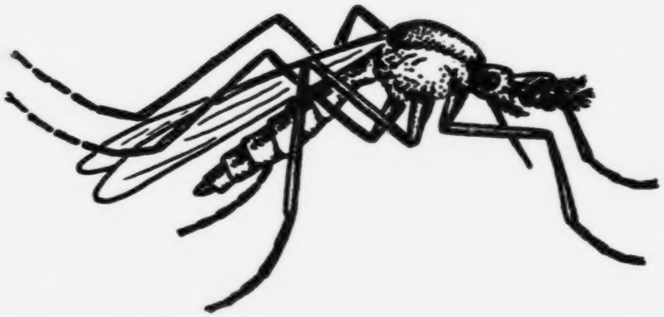
BEST COPY AVAILABLE

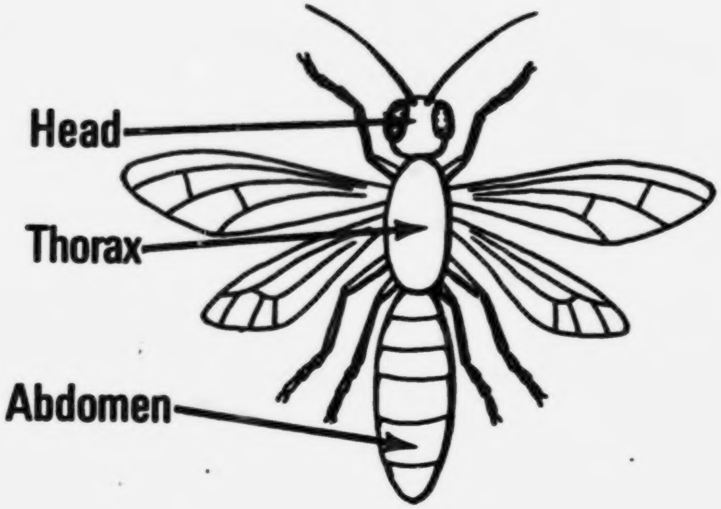
TM #2

Adult Insects





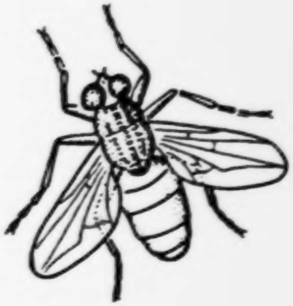



Head
Thorax
Abdomen

TM #3

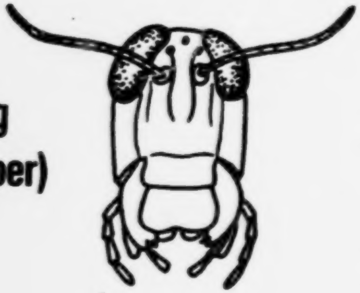
CSS 11 12

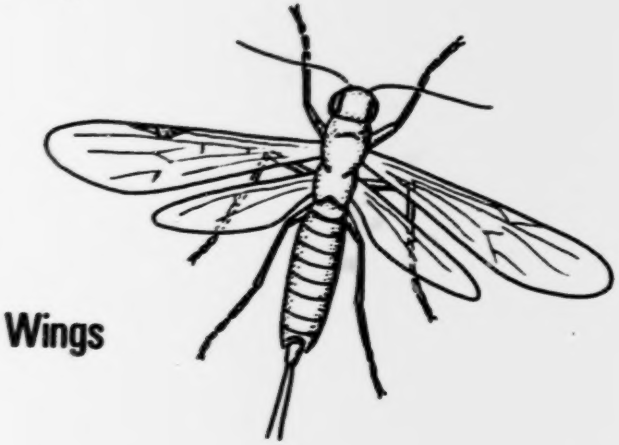
Wings and Mouthparts



Two Wings

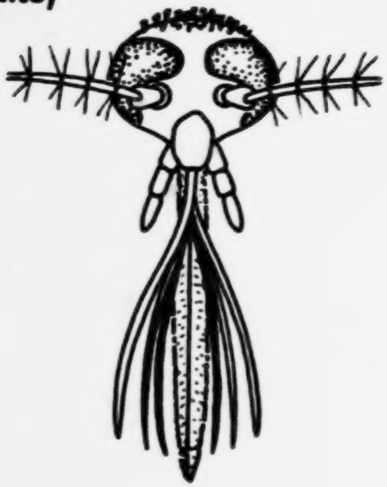
Chewing
(Grasshopper)





Four Wings

Sucking
(Mosquito)



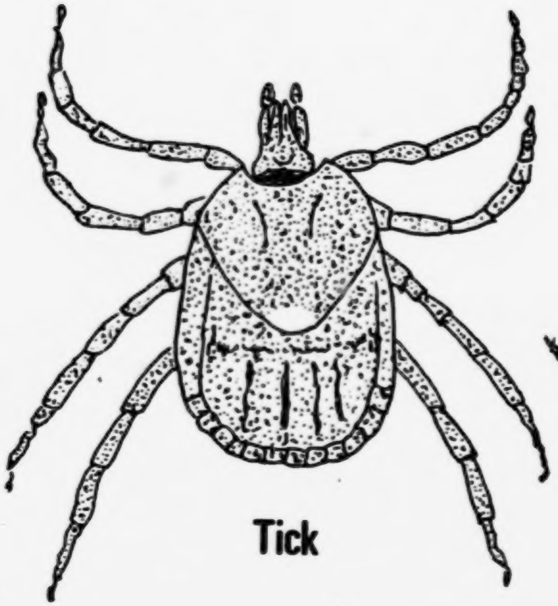
Wings

Mouthparts

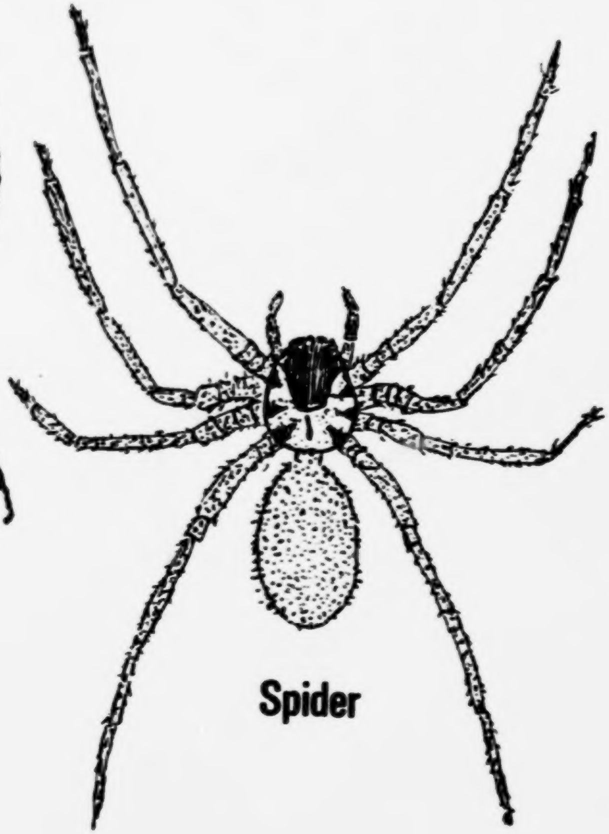
TM #4

CSS 11 13

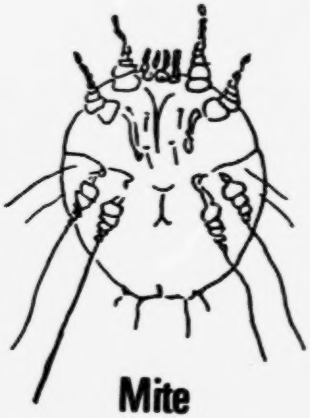
Mite, Tick, and Spider



Tick



Spider



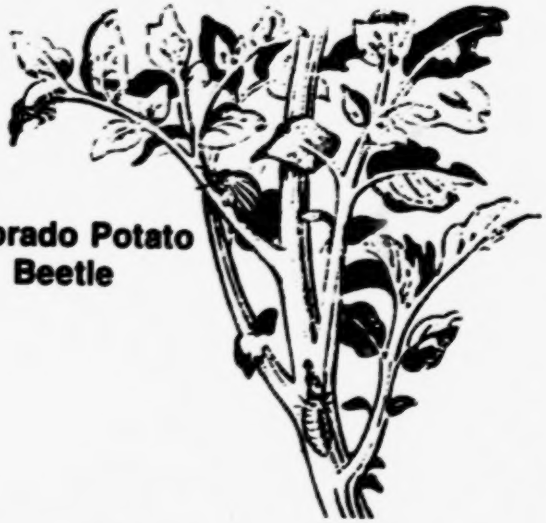
Mite

TM #5

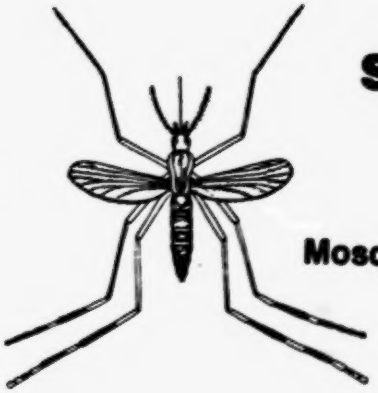
CSS 11 14

Insect Classification According to Feeding Habits

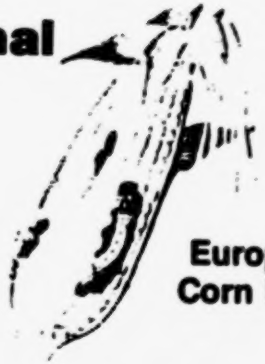
Chewing


Colorado Potato Beetle

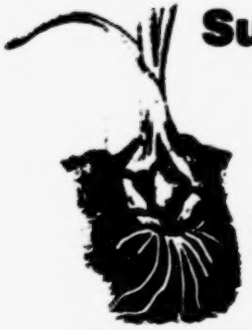
Sucking



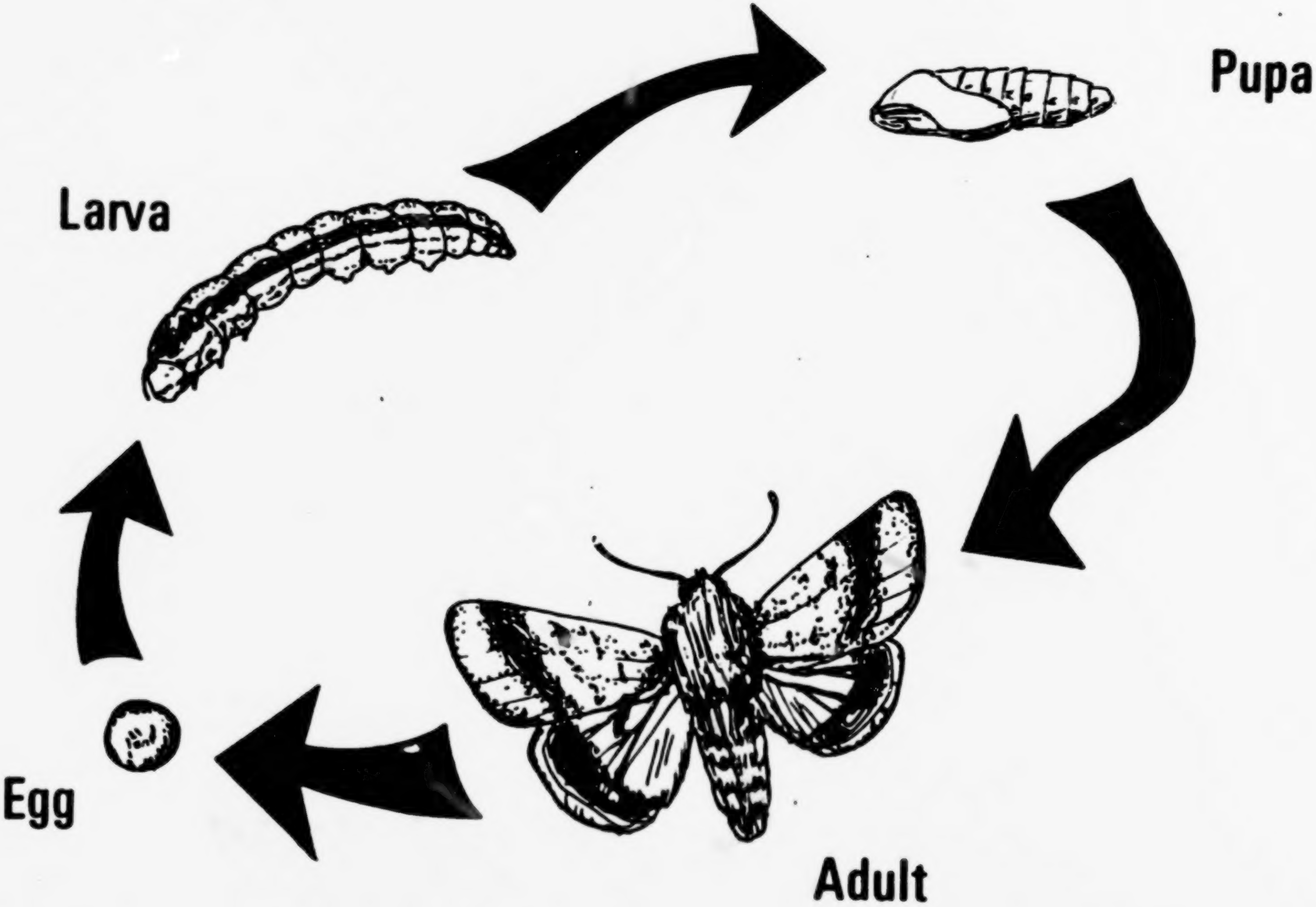
Internal


European Corn Borer

Subterranean



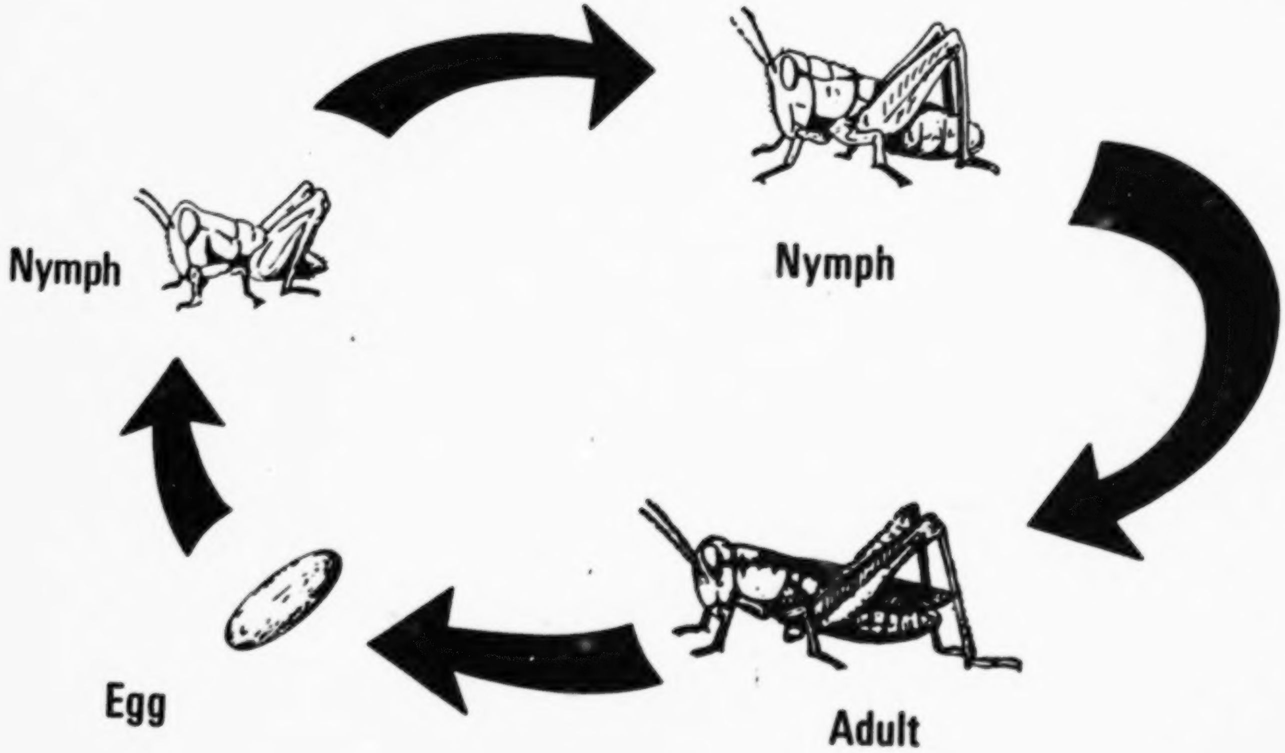
Four Stage Life Cycle


Pupa
Larva
Egg
Adult

TM #7

CSS 11 16

Three Stage Life Cycle


Nymph
Nymph
Adult
Egg

TM #8

CSS 11 17

INSECT PESTS OF CROPS
UNIT 11

TEST

NAME_______________________________________ SCORE_________________

1. Match terms associated with insect pests of crops to the correct definitions. Write the correct numbers in the blanks.

1. Insect
2. Spider
3. Mite
4. Entomology
5. Life cycle
6. Metamorphosis
7. Complete metamorphosis
8. Incomplete metamorphosis
9. Larva
10. Pupa
11. Cocoon
12. Nymph
13. Damage
14. Injury
15. Pesticide
16. Insecticide
17. Acaricide

_____a. A change in form, either gradual or sudden

_____b. A silken case inside which the pupa is formed

_____c. Stages in the development of an insect

_____d. Chemical used to control pests

_____e. Any of a large number of tiny arachnids, many of which live as parasites upon plants

_____f. Immature form of an insect having complete matamorphosis

_____g. Associated with crop loss and/or reduction in crop yield or crop quality

_____h. A branch of science that deals with the study of insects

_____i. A small, eight legged arachnid having a body composed of two divisions

_____j. Gradual change in appearance as growth proceeds

_____k. Stage between the larva and adult in insects with complete metamorphosis

_____l. A pesticide used to kill or control insects

_____m. Having four distinct growth stages in development in which a major change in structure and appearance of the insect occurs

TEST

_____n. The immature stage of an insect with incomplete metamorphosis

_____o. Deviation from normal appearance of the plant, from which it may recover, and not depress yield and/or quality

_____p. Pesticide used to control mites, ticks, and spiders

_____q. Small, boneless animal whose body is divided into three sections and has six legs

2. Name three ways insects cause losses to crops.

a. ____

b. ____

c. ____

3. Select from the following list beneficial effects of insects. Write an "X" in the blank before each correct answer.

_____a. Silk production

_____b. Spread plant disease

_____c. Lower crop quality

_____d. Natural enemies of harmful insects

_____e. Honey

_____f. Pollination

4. Discuss the economic importance of insect control.

____

____

____

____

____

____

____

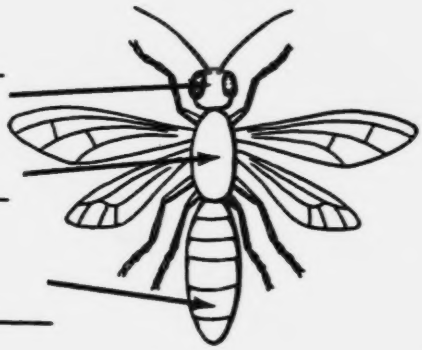
TEST

5. Label the body regions of an insect. Write the correct names in the blanks.

a. ______________

b. ______________

c. ______________



6. Name two characteristics which aid in distinguishing one insect from another.

a. ______________________________

b. ______________________________

7. Name three identifying characteristics of mites, ticks, and spiders.

a. ______________________________

b. ______________________________

c. ______________________________

8. Match the insect feeding habit to the correct description. Write the correct numbers in the blanks.

1. Chewing
2. Sucking
3. Internal
4. Subterranean

_____a. This group includes mostly chewing insects that enter the plant and feed from within; european corn borer

_____b. These insects pierce plant tissue with their "coke straw" beak and feed on plant fluids; aphids

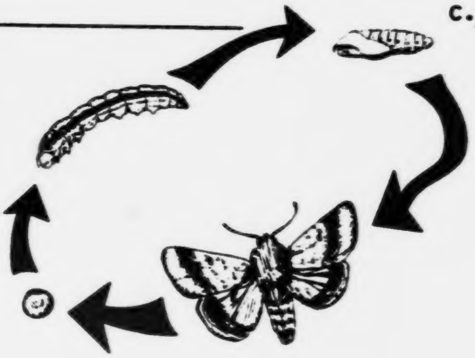
_____c. These insects biteoff, chew, and swallow plant parts; potato beetle

_____d. This group includes both chewing and sucking insects which feed on the plant below the soil surface

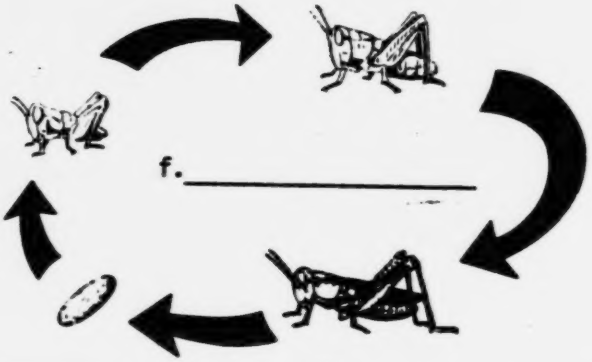
TEST

9. Label the life cycles of insects. Write the correct names in the blanks.

Four Stage Life Cycle



Three Stage Life Cycle



10. Select from the following list cultural control practices for insects. Write an "X" in the blank before each correct answer.

_____a. Discing under grain stubble

_____b. Crop rotation

_____c. Use of natural enemies to control insects

_____d. Application of insecticides

_____e. Trap crops

_____f. Use of crop varieties resistant to insects

_____g. Proper timing of planting or harvesting operations

TEST

11. Select from the following list biological control practices for insects. Write an "X" in the blank before each correct answer.

_____a. Application of pesticide to infected area

_____b. Using wasps to control cereal leaf beetles

_____c. Proper timing of tillage operations

_____d. Use of resistant crop varieties

_____e. Shredding of crop residue

_____f. Use of natural enemies

12. Select from the following list chemical control practices for insects. Write an "X" in the blank before each correct answer.

_____a. Application of malathion to control aphids

_____b. Crop rotation

_____c. Soil application of Temik to control potato insects

_____d. Trap crops to attract insects

_____e. Insecticide application to infected crop

_____f. Use of resistant crop varieties

13. Match classifications of insecticides to the correct description. Write the correct numbers in the blanks.

1. Fumigant poison
2. Stomach poison
3. Contact poison

_____a. Eaten and digested by the insect

_____b. Enters through the respiratory system in the form of a gas

_____c. Absorbed through the body wall of the insect

INSECT PESTS OF CROPS
UNIT 11

ANSWERS TO TEST

1.

a.	6	f.	9	k.	10	p.	17
b.	11	g.	13	l.	16	q.	1
c.	5	h.	4	m.	7		
d.	15	i.	2	n	12		
e.	3	j.	8	o.	14		

2. Answer should include any three of the following

   a. Reduce crop yield
   b. Reduce crop quality
   c. Cost of control activities
   d. Transmit plant disease

3. a, d, e, f

4. Evaluated to satisfaction of instructor

5. a. Head b. Thorax c. Abdomen

6. a. Wings b. Mouthparts

7. a. Eight jointed legs
   b. Two body regions
   c. No wings

8. a. 3 b. 2 c. 1 d. 4

9. a. Egg e. Egg
   b. Larva f. Nymph
   c. Pupa g. Adult
   d. Adult

10. a, b, e, f, g

11. b, f

12. a, c, e

13. a. 2 b. 1 c. 3

PLANT DISEASE IDENTIFICATION AND CONTROL
UNIT 12

UNIT OBJECTIVE

After completing this unit the student should be able to match terms and definitions, list the five groups of biological pathogens, and discuss methods of prevention and control of plant disease. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with plant disease identification and control to the correct definitions.
2. Name three ways diseases cause economic loss in plants.
3. Name the five groups of biological pathogens.
4. Match types of fungi to the correct description.
5. Name three methods by which pathogens spread.
6. Match the general approaches to disease control to the correct description.
7. Name three primary disease control methods available to the farmer.
8. Select from a list practices used to control plant disease.
9. Select from a list diseases caused by fungal infection.
10. Select from a list diseases caused by bacterial infection.
11. Select from a list diseases caused by viral or viroid infection.
12. Select from a list diseases caused by nematode infection.
13. Select from a list diseases caused by mycoplasm infection.

PLANT DISEASE IDENTIFICATION AND CONTROL
UNIT 12

SUGGESTED ACTIVITIES

I. Suggested activities

- A. Order materials to supplement unit
  - 1. Literature
    - a. Field Crop Diseases, manual available from Ohio Agriculture Education Curriculum Materials Center, Ohio State University, Columbus, OH, 43210; approx. cost $3.00, order no. 1017M.
  - 2. Filmstrips, slideshows, etc.
    - a. Symptomology and Control of Common Crop Disease, 107 slides and cassette, available from Hobar Publications, 1234 Tiller Lane, St. Paul, MN, 55112; approx. cost $145.60, order no. D12.
  - 3. Films
- B. Make transparencies
- C. Provide students with objective sheet
- D. Provide students with information sheet
- E. Discuss unit and specific objectives
- F. Discuss information sheet
- G. Invite local extension agent or crop specialist to speak to class on local diseases and control practices
- H. Give test
- I. Reteach if necessary
- J. Retest

SUGGESTED ACTIVITIES

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Transparency masters
    - 1. TM 1--Biological pathogens
    - 2. TM 2--Means by which pathogens spread
    - 3. TM 3--Symptoms of diseases
    - 4. TM 4--Fungi
    - 5. TM 5--Fungi
    - 6. TM 6--Bacterial diseases
    - 7. TM 7--Bacterial diseases
    - 8. TM 8--Viruses
    - 9. TM 9--Nematodes
- E. Test
- F. Answers to test

III. Unit references

- A. Delorit, R.J., et al Crop Production 4th edition. Englewood Cliffs, New Jersey. Prentice-Hall, Inc.
- B. Plant Diseases. Oklahoma State Board for Vocational-Technical Education. Still water, OK. Oklahoma State University: Ag II, Unit VIII.
- C. Insect and Disease Control. Vocational Instructional Services. College Station, Texas. Texas A & M University: Vo-Ag II, Unit IV-D.

PLANT DISEASES IDENTIFICATION AND CONTROL
UNIT 12

INFORMATION SHEET

I. Terms and definitions

A. Plant disease--An abnormal plant condition caused by a pathogen, or improper environmental condition

B. Pathogen--A disease-producing agent

C. Host--Plant that is susceptible to a pathogen

D. Fungi--Small filamentous organisms that lack chlorophyll and which cause rots, mildews, and other diseases

E. Bacteria--A single-celled microscopic organism

F. Nematode--Tiny, tubular, unsegmented, eel-like worms that feed on plant parts

G. Nematicide--Pesticide used to control nematodes

H. Virus--A submicroscopic entity consisting of nucleic acids and amino acids capable of causing mosaic and other diseases

I. Blight--Rapid discoloration and death of tissue over certain portions of the plant

J. Fungicide--Chemical or biological material used to kill or destroy fungi

K. Resistant--Inherited ability of a plant to retard growth of disease-causing organisms

L. Scab--Crust-like, diseased lesion produced as a result of disease infection

M. Lesion--A localized area of discolored diseased tissue

N. Wilt--Loss of freshness and drooping leaves

O. Gall--Knob on the plant parts produced by certain nematodes, bacteria or fungi causing stunting, chlorosis, necrosis, malformations and may result in reduction of yield or quality

P. Chlorosis--Loss of green color (yellowing or whitening) in foliage

Q. Symptom--Evidence or indicator of disease; reaction of a plant to a pathogen

R. Necrosis--Death of plant parts

S. Sign--Visible evidence of the pathogen

INFORMATION SHEET

II. Diseases cause economic loss in plants

A. Reduced yield

B. Reduced crop quality

C. Spoilage in storage and transportation

D. Render food unfit for use

E. Cost of control activities

III. Groups of biological pathogens (Transparency #1)

A. Fungi

B. Bacteria

C. Virus and viroids

D. Nematodes

E. Mycoplasmas

IV. Types of fungi

A. Saprophytic fungi--Fungi that live on dead or decaying organic matter

(Note: They are important because they eventually release the nutrients they take from dead plants and animals, thus contributing to soil fertility. Some species, such as mushrooms and truffles, are edible and of considerable economic importance.)

B. Parasitic fungi--Fungi that live on or in a living host plant; may be obligate or non-obligate parasites

(Note: About 7500 parasitic fungi are of economic importance because of the damage and yield reduction in affected crops.)

V. Means by which pathogens spread (Transparency #2)

A. Wind

B. Rain

C. Insects, mites

D. Machinery

INFORMATION SHEET

VI. General approaches to disease control (Transparency #3)

(Note: Satisfactory control of most plant diseases requires the application of several control measures and usually involves an integrated program of environmental, biological and chemical factors. Correct diagnosis is essential to plant disease control. Then, control involves the application of one or more of the following principles.)

A. Avoidance--Avoiding disease by planting when and/or where pathogens are ineffective or absent

B. Exclusion--Keeping pathogens out of a "clean" area

C. Eradication--Eliminating the pathogen source, whether an infected plant, field or region

D. Protection--Preventing an infection by using a chemical or physical barrier to keep pathogens out

E. Resistance--Using plants that tolerate, resist or are immune to the disease

F. Therapy--Reducing the severity of disease in an infected plant

VII. Primary disease control methods available to the farmer

A. Cultural practices

(Note: Crop management to minimize development of disease is the oldest and most applicable approach. A pathogen and its host must be brought together under proper environmental conditions for a disease to develop. Cultural practices are used to alter the environment, the condition of the host or the behavior of the pathogen to prevent an infection.)

B. Control through disease resistance

(Note: Resistant varieties have been one of the major factors in maintaining high levels of crop productivity in the United States. For many diseases of forage and field crops with relatively low values per acre, chemical controls often cannot be used because the profit margin is too low. For these cases, resistant varieties provide the only means of ensuring continued protection.)

C. Chemical control

(Note: The use of fungicides is dependent on the crop, the disease and the specific conditions for use. For specific recommendations, contact your county Extension agent or chemical supplier. For best results, the chemicals should be used with other control methods in a planned strategy.)

INFORMATION SHEET

VIII. Practices used to control plant diseases

A. Use of resistant varieties

B. Eradication of alternate host plants

C. Treatment of soil

D. Rotation of crops

E. Destruction of plant residue

F. Use of disease-free seed

G. Applications of fungicides

IX. Diseases caused by fungal infection (Transparencies #4 and #5)

A. Rusts--Wheat, oats, barley, rye

B. Powdery mildew--Grains, legumes

C. Downy mildew--Grains, alfalfa, onion, cucumber

D. Smuts--Corn, wheat, oats, barley, grasses

E. Ergot--Rye, wheat, barley and other grasses

F. Scab--Barley, wheat, rye

G. Seed decay, damping off, root rots--All plants

H. Wilts--Potatoes, alfalfa, trees

I. Soft rots, dry rots--Fleshy organs, potatoes, onions, carrots, etc.

J. Scab--Potatoes

K. Cankers--Woody plants

X. Diseases caused by bacterial infection (Transparencies #6 and #7)

A. Bacterial wilts--Corn, alfalfa, potato

B. Galls--Crown gall on many crops, trees

C. Leaf spot--Cotton, beans, peas, trees

D. Blights--Vegetable crops, fruit trees

E. Cankers--Woody plants

F. Soft rots--Fleshy or succulent plant parts

INFORMATION SHEET

XI. Diseases caused by viral infection (Transparency #8)

A. Mosaic—Tomato, potato, beans, corn, small grains, forage, legumes, pease, sugarbeets, cucurbits

B. Curly top—Tomato, beans, sugarbeets

C. Yellows—Barley yellow dwarf, potato leaf roll, sugar beet yellows

XII. Diseases caused by nematode infections (Transparency #9)

A. Galls--Root-knot nematodes; over 2000 hosts

B. Hairy Root—Cyst nematodes; sugar beet, soybean, potato

C. Root Lesions--Lesion nematodes; over 2000 hosts

D. Necrosis, stunting--Foliar nematodes; alfalfa, clover, onions

XIII. Diseases caused by mycoplasmas

A. Aster yellows--Several hosts

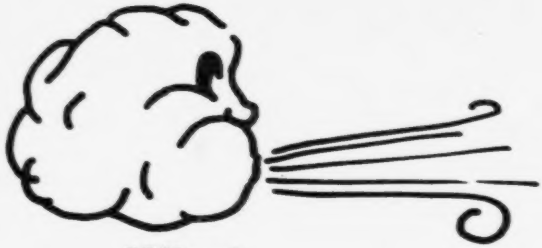
B. Pear decline--Pears

C. Western X—Stone fruit trees

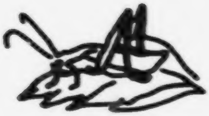
Biological Pathogens

1. Fungi
2. Bacteria
3. Virus and viroids
4. Nematodes
5. Mycoplasmas

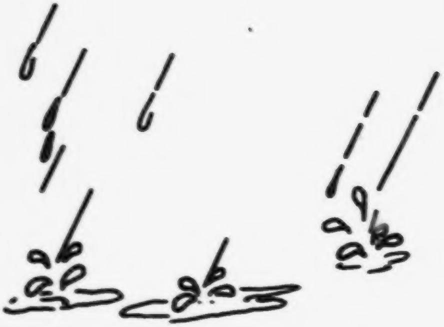
Means by Which Pathogens Spread



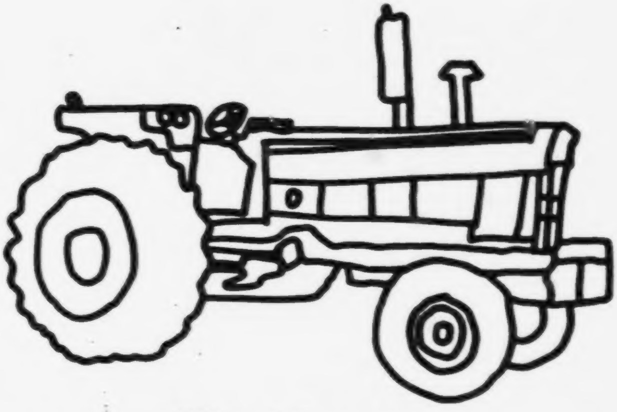
Wind



Insects

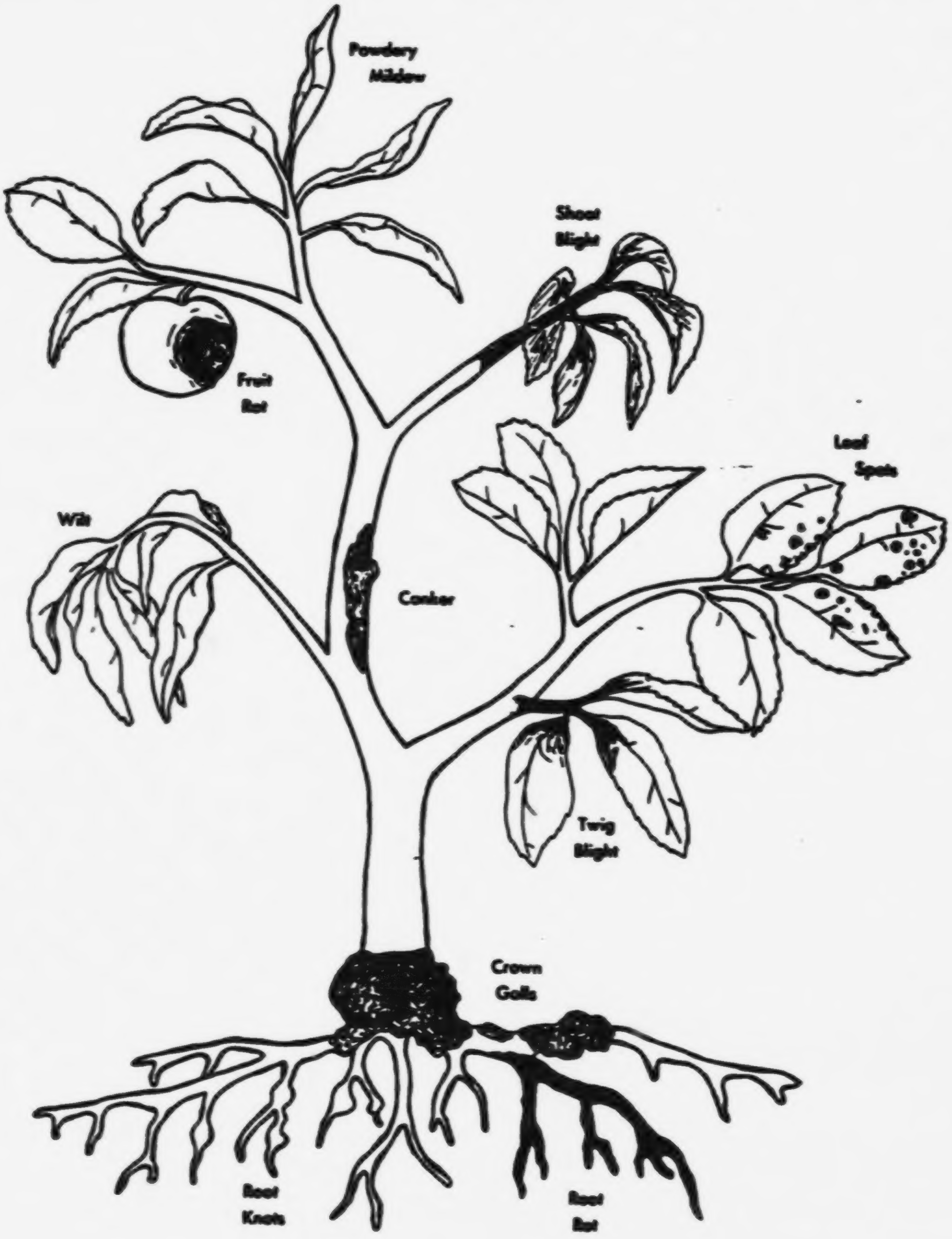


Rain

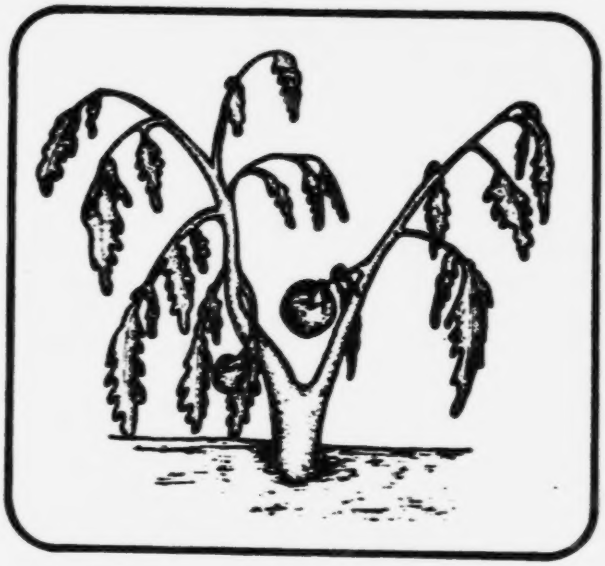


Machinery

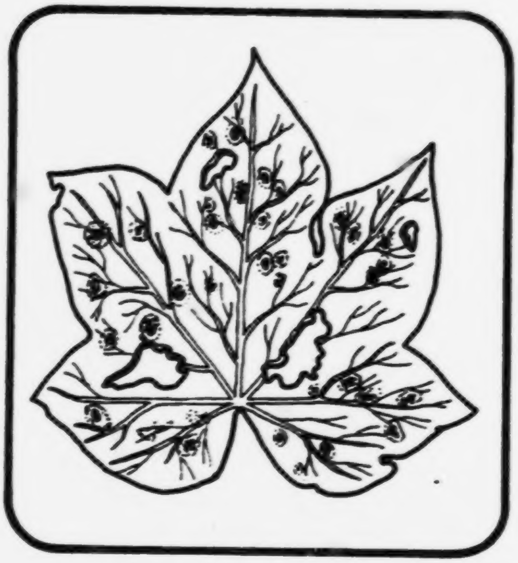
Symptoms of Diseases


Powdery Mildew
Shoot Blight
Fruit Rot
Leaf Spots
Wilt
Canker
Twig Blight
Crown Galls
Root Knots
Root Rot

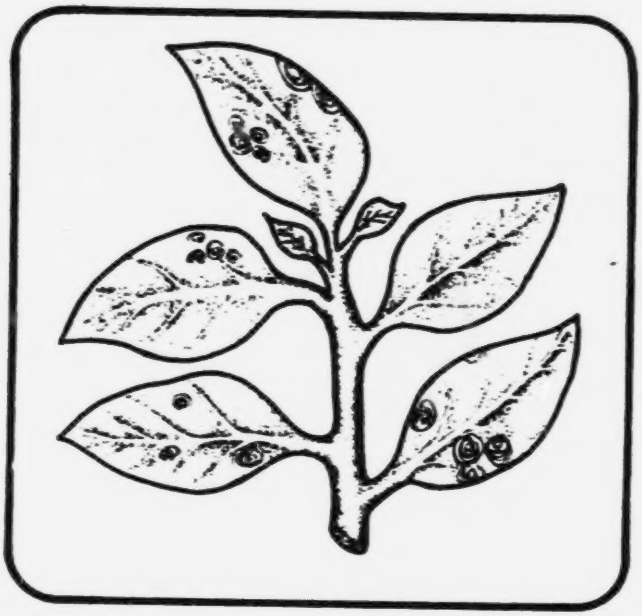
FUNGI



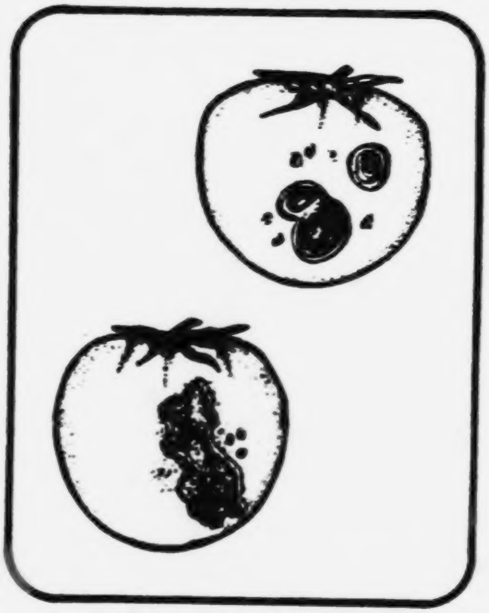
WILT - CAUSED BY FUNGI ENTERING ROOT AND STEM



RUST ON COTTON

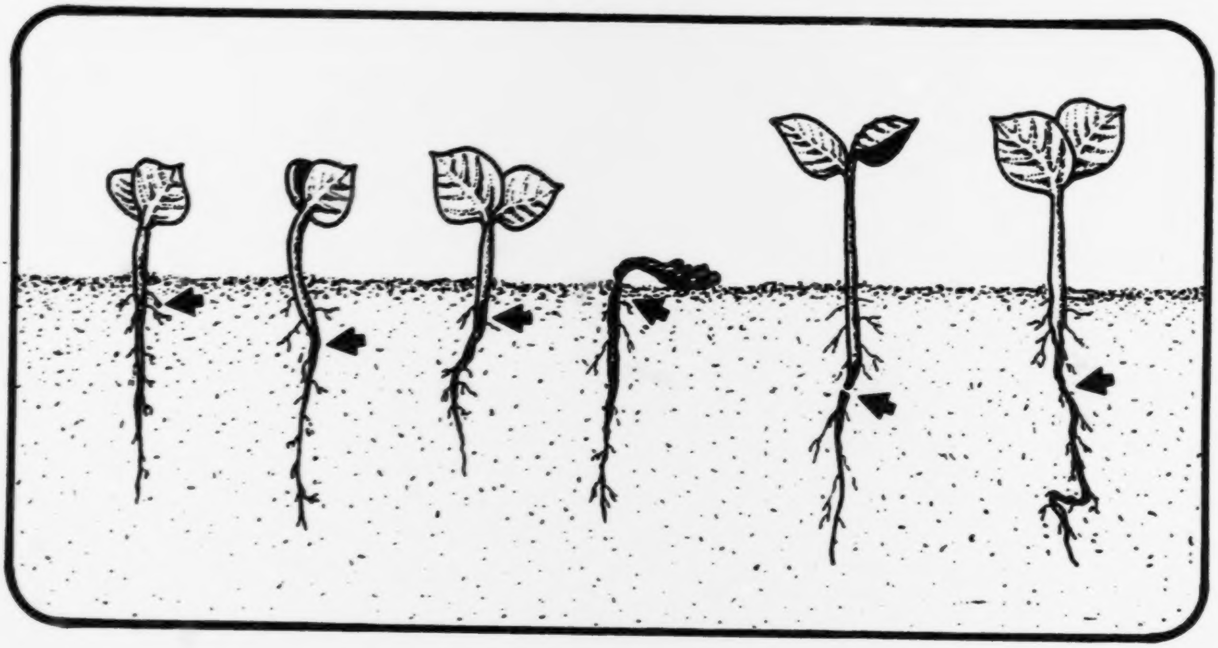


LEAF SPOT - OR EARLY BLIGHT

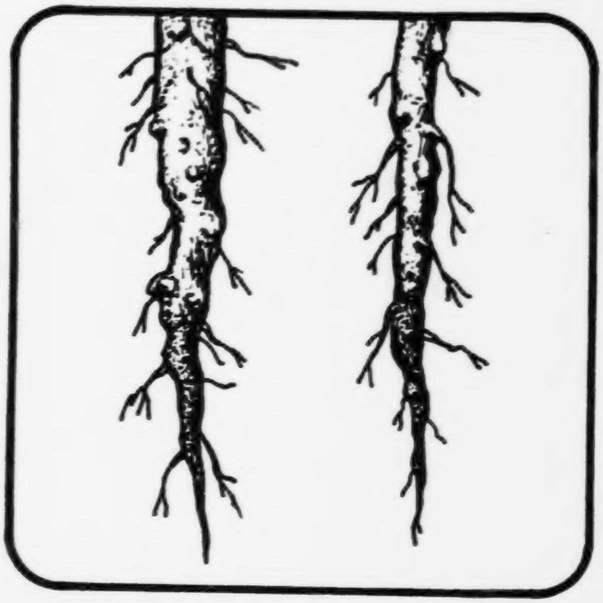


SOIL ROT IN WET SOIL

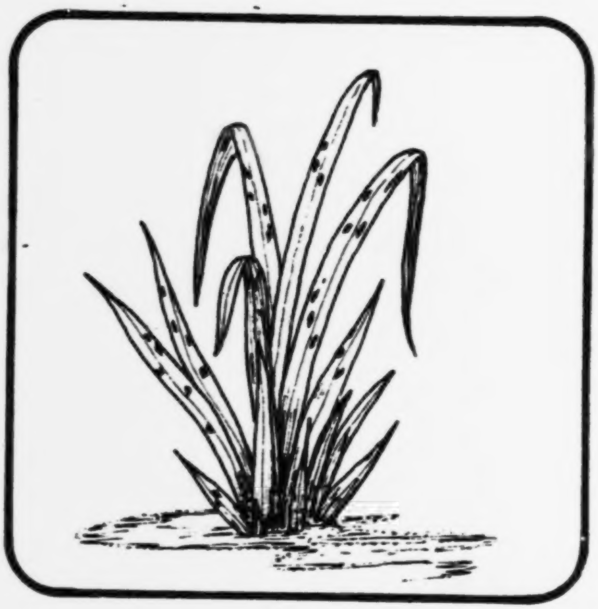
FUNGI



YOUNG PLANT ROOTS DESTROYED BY FUNGI

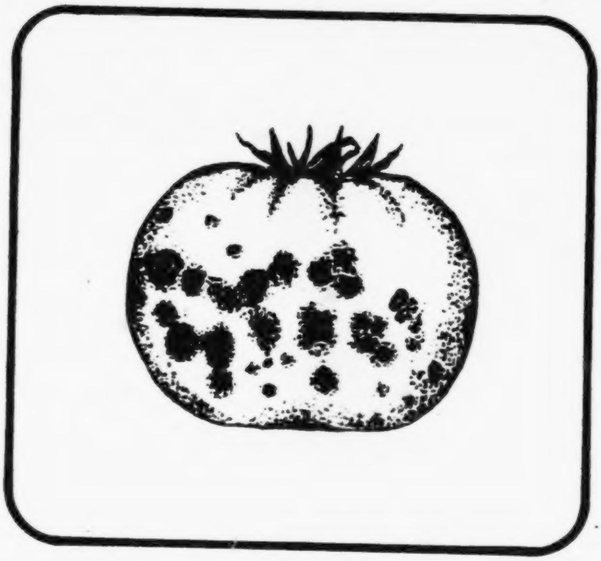


COTTON ROOT ROT

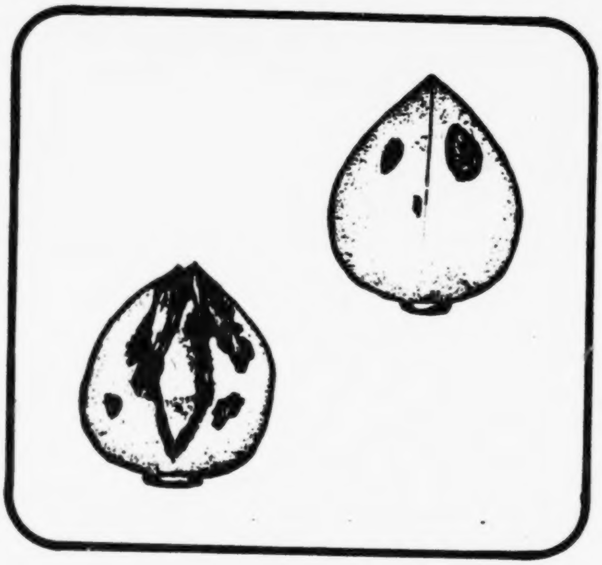


RUST FUNGUS ON GRASS

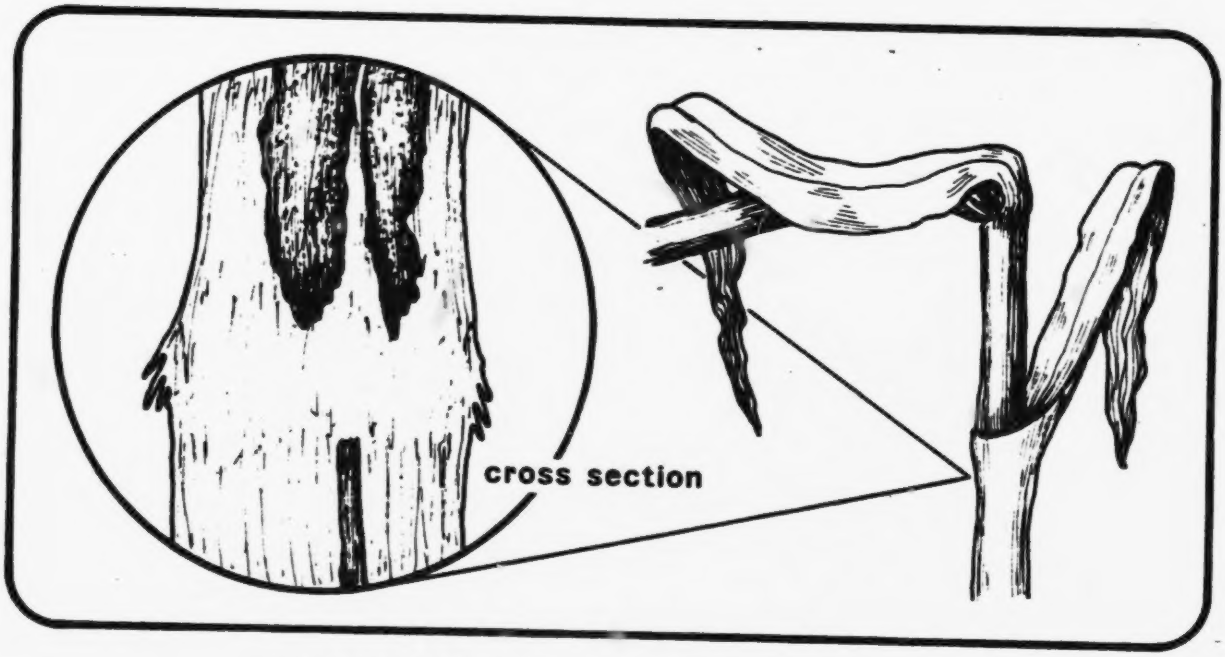
BACTERIAL DISEASES



BACTERIAL SPOT
ON TOMATO

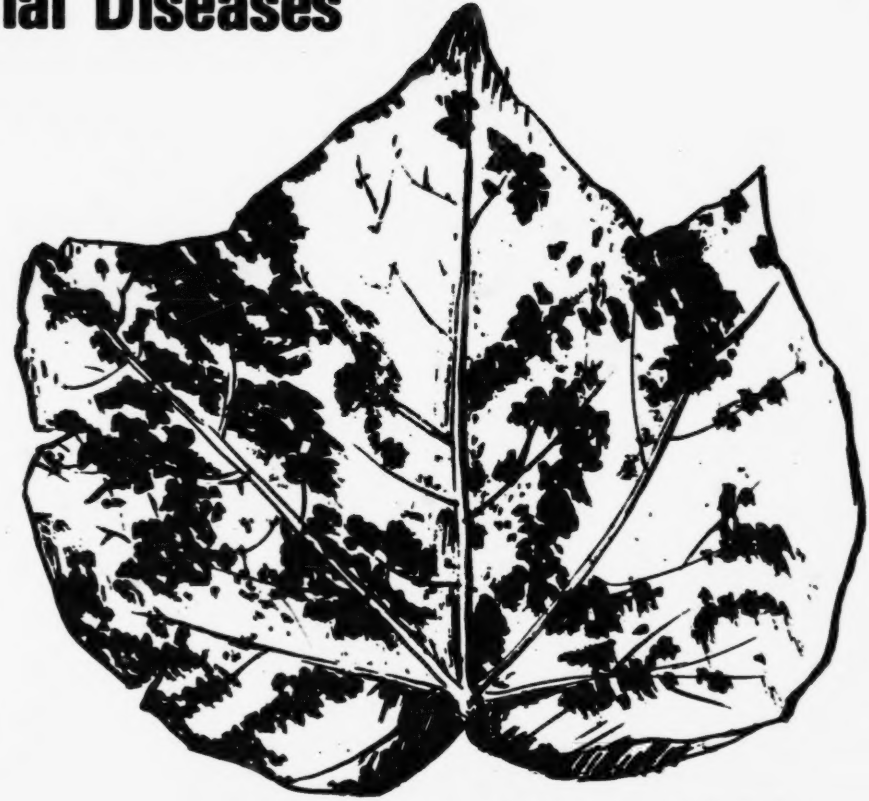


BACTERIAL BLIGHT
ON COTTON BOLLS


cross section

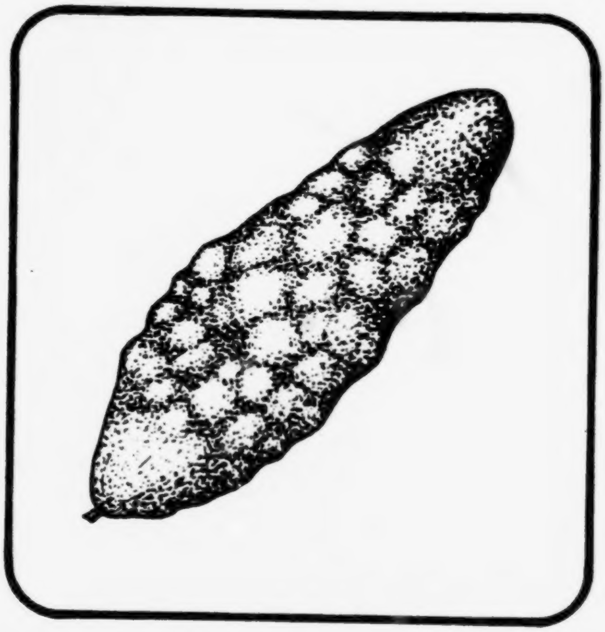
STALK ROT DISEASE IN CORN PLANT

Bacterial Diseases

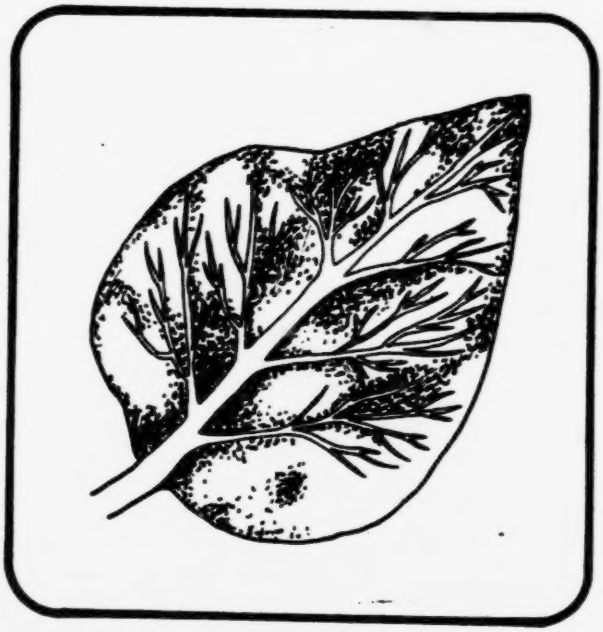


Cotton Leaf Blight

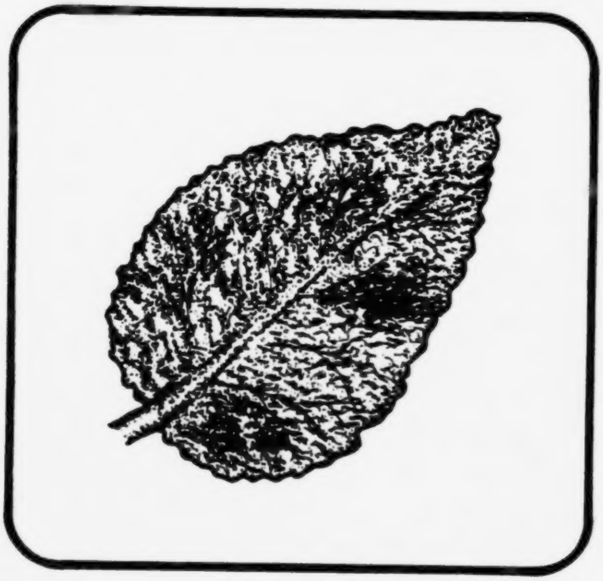
VIRUSES



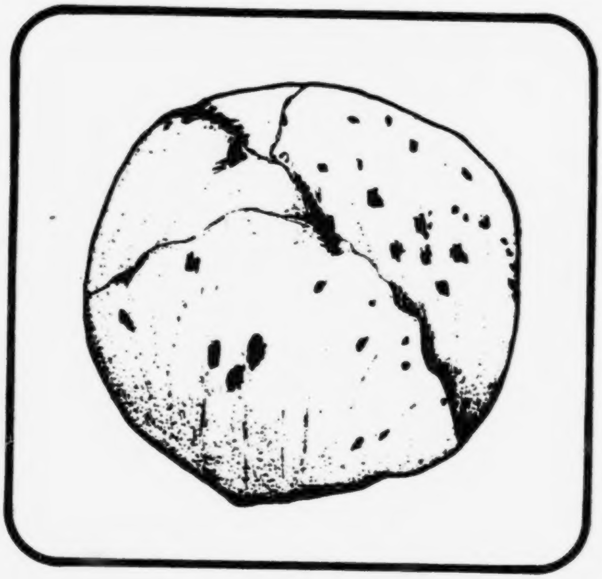
CUCUMBER WITH DARK GREEN WARTS - MOSAIC VIRUS



DARK GREEN MOTTLING DUE TO MOSAIC VIRUS

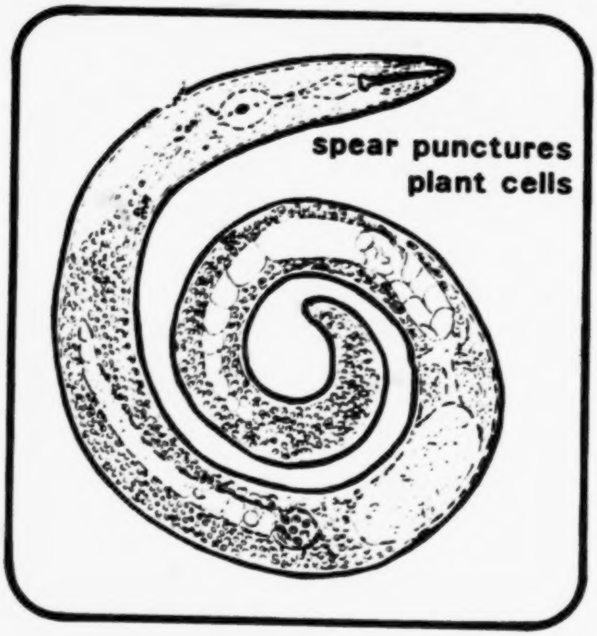


LEAF WRINKLED DUE TO VIRUS

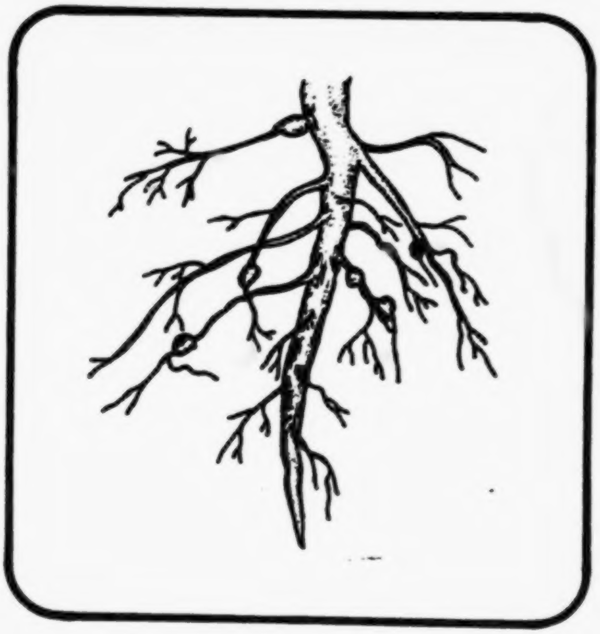


MOSAIC VIRUS ON CABBAGE

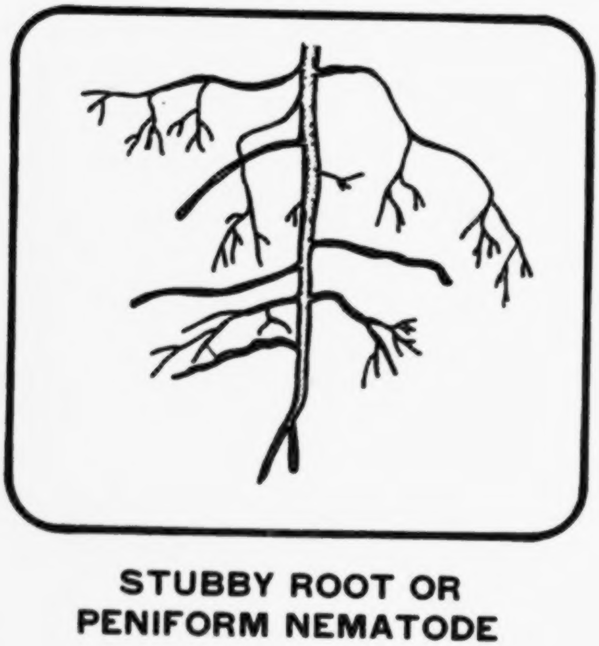
NEMATODES


spear punctures
plant cells

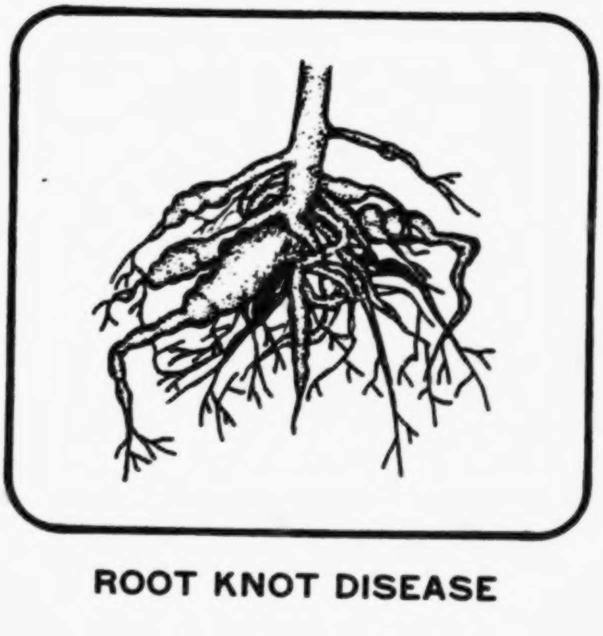
NEMATODE
(size less than 2.0 mm)



GALLS OR KNOTS ON ROOTS



STUBBY ROOT OR
PENIFORM NEMATODE



ROOT KNOT DISEASE

PLANT DISEASE IDENTIFICATION AND CONTROL
UNIT 12

TEST

NAME____ SCORE________________

1. Match terms associated with plant disease identification and control to the correct definitions. Write the correct numbers in the blanks.

1. Plant disease
2. Pathogen
3. Host
4. Fungi
5. Bacteria
6. Nematode
7. Nematicide
8. Virus
9. Blight
10. Fungicide
11. Resistant
12. Scab
13. Lesion
14. Wilt
15. Gall
16. Chlorosis
17. Symptom
18. Necrosis
19. Sign

_____a. Knob on the plant parts produced by certain nematodes, bacteria, or fungi; may result in reduction of yield or quality

_____b. Chemical material used to kill or destroy fungi

_____c. A single-celled microscopic organism

_____d. A disease producing agent

_____e. Inherited ability of a plant to retard growth of disease-causing organisms

_____f. Loss of green color in foliage

_____g. Death of plant parts

_____h. Crust-like, diseased lesion produced as a result of disease infection

_____i. An abnormal plant condition caused by a pathogen, or improper environmental condition

_____j. Evidence or indicator of disease; reaction of a plant to a pathogen

_____k. Small, filamentous organisms that lack chlorophyll

_____l. Pesticide used to control nematodes

_____m. Loss of freshness and drooping leaves

TEST

_____n. Visible evidence of the pathogen

_____o. Tiny, tubular, unsegmented, eel-like worms that feed on plant parts

_____p. A submicroscopic entity consisting of nucleic acids and amino acids capable of causing mosaic and other diseases

_____q. A localized area of discolored diseased tissue

_____r. Rapid discoloration and death of tissue over certain portions of the plant

_____s. Plant that is susceptible to a pathogen

2. Name three ways diseases cause economic loss in plants.

a. ______________________________

b. ______________________________

c. ______________________________

3. Name the five groups of biological pathogens.

a. ______________________________

b. ______________________________

c. ______________________________

4. Match the types of fungi to the correct description. Write the correct numbers in the blanks.

1. Saprophytic fungi 2. Parasitic fungi

_____a. Fungi that live on dead or decaying organic matter

_____b. Fungi that live on or in a living host plant

5. Name three methods by which pathogens spread.

a. ______________________________

b. ______________________________

c. ______________________________

TEST

6. Match the general approaches to disease control to the correct description. Write the correct numbers in the blanks.

1. Avoidance	4. Protection
2. Exclusion	5. Resistance
3. Eradication	6. Therapy

_____a. Eliminating the pathogen source, whether an infected plant, field, or region

_____b. Reducing the severity of disease in an infected plant

_____c. Keeping pathogens out of a "clean" area

_____d. Using plants that tolerate, resist, or are immune to the disease

_____e. Avoiding disease by planting when and/or where pathogens are ineffective or absent

_____f. Preventing an infection by using a chemical or physical barrier to keep pathogens out

7. Name three primary disease control methods available to the farmer.

a.____

b.____

c.____

8. Select from the following list practices used to control plant diseases. Write an "X" in the blank before each correct answer.

_____a. Applications of fungicides

_____b. Use of disease-free seed

_____c. Destruction of crop residue

_____d. Rotation of crops

_____e. Treatment of soil

_____f. Eradication of alternate host plants

_____g. Use of resistant varieties

TEST

9. Select from the following list diseases caused by fungal infection. Write an "X" in the blank before each correct answer.

_____a. Bacterial blight

_____b. Root rots

_____c. Mosaic

_____d. Downey mildew

_____e. Damping off

_____f. Scab

10. Select from the following list diseases caused by bacterial infection. Write an "X" in the blank before each correct answer.

_____a. Smuts

_____b. Leaf spot

_____c. Bacterial blight

_____d. Hairy root

_____e. Curly top

_____f. Bacterial wilts

11. Select from the following list diseases caused by viral or viroid infection. Write an "X" in the blank before each correct answer.

_____a. Mosaic

_____b. Curly top

_____c. Yellows

_____d. Downey mildew

_____e. Powdery mildew

_____f. Blights

TEST

12. Select from the following list diseases caused by nematode infection. Write an "X" in the blank before each correct answer.

_____a. Rusts

_____b. Pear decline

_____c. Root lesions

_____d. Western X

_____e. Mosaic

_____f. Hairy root

13. Select from the following list diseases caused by mycoplasm infection. Write an "X" in the blank before each correct answer.

_____a. Aster yellows

_____b. Downey mildew

_____c. Western X

_____d. Blights

_____e. Pear decline

_____f. Root lesions

PLANT DISEASE IDENTIFICATION AND CONTROL
UNIT 12

ANSWERS TO TEST

1. a. 15
   b. 10
   c. 5
   d. 2
   e. 11
   f. 16
   g. 18
   h. 12
   i. 1
   j. 17
   k. 4
   l. 7
   m. 14
   n. 19
   o. 6
   p. 8
   q. 13
   r. 9
   s. 3

2. Answer should include any three of the following

   a. Reduced yield
   b. Reduced crop quality
   c. Spoilage in storage and transportation
   d. Render food unfit for use
   e. Cost of control activities

3. a. Fungi
   b. Bacteria
   c. Virus and viroids
   d. Nematodes
   e. Mycoplasmas

4. a. 1 b. 2

5. Answer should include any three of the following

   a. Wind
   b. Rain
   c. Insects, mites
   d. Machinery

6. a. 3 b. 6 c. 2 d. 5 e. 1 f. 4

7. a. Cultural practices
   b. Control through disease resistance
   c. Chemical control

8. a, b, c, d, e, f, g

9. b, d, e, f

10. b, c, f

11. a, b, c

12. c, f

13. a, c, e

WA841 3330

CROP AND SOIL SCIENCE

A

CURRICULUM GUIDE

FOR

IDAHO

VOCATIONAL AGRICULTURE INSTRUCTORS

VOLUME 2

Developed and written by:

Richard L. Ledington

Provided through a grant from the

Idaho State Department of Vocational Education
and the
Washington State Commission For Vocational Education

1985

Administered through the
Department of Agricultural and Extension Education
University of Idaho

By

Doug Pals, John Slocombe; Project Directors

Richard L. Ledington, Associate Director and Curriculum Guide Coordinator

CROP AND SOIL SCIENCE

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Unit 21 .... Rangeland Management
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Many individuals have also made substantial contributions to the development and publication of this guide. While all of them cannot be recognized, we do extend our sincere thanks for their contributions and efforts. The following people were especially influential in the development of this guide.

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USE OF THIS PUBLICATION

Introduction

This material must be taught. It does not replace the teacher, nor the teacher's expertise. The teacher needs to adapt the material to the local area and individual students. The teacher must also provide the necessary motivating techniques to help the students learn the material.

Instructional Units

The "Crop and Soil Science" curriculum guide has 24 units. Units 1 through 6 are general units covering topics common to soil science. Units 7 through 24 are units covering topics common to crop production. These units are not geared to a particular age level and must be adapted to the students they are used for. Each unit includes objectives and competencies, suggested activities for the instructor and students, information sheet, transparency masters, assignment and/or job sheets, answers to assignment sheets, test and answers to test. Units are planned for more than one lesson or class period.

The teacher should carefully study each instructional unit to determine:

A. The appropriateness of the material for the age level

B. The amount of material that can be covered during a class period

C. Additional objectives and/or assignments which could be developed

D. The skills which must be demonstrated

  1. Supplies needed

  2. Equipment needed

  3. Amount of practice needed

  4. Amount of class time needed for demonstrations

E. Supplementary materials, such as pamphlets, filmstrips and slides, that must be ordered

F. Resource people who must be contacted

Objectives and Competencies

Each unit of instruction is based on stated objectives. These objectives state the goals of the unit, thus providing a sense of direction and accomplishment for the student.

The objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the student performances necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which may have been used in this material:

Name

- Label
- List in writing
- List orally
- Letter
- Record
- Repeat
- Give

Identify

- Select
- Mark
- Point out
- Pick out
- Choose
- Locate
- Match

State a Rule

- Calculate

Apply a Rule

Describe

- Define
- Discuss in writing
- Discuss orally
- Interpret
- Tell how
- Tell what
- Explain

Order

- Arrange
- Sequence
- List in order
- Classify
- Divide
- Isolate
- Sort

Distinguish

- Discriminate

Construct

- Draw
- Make
- Build
- Design
- Formulate
- Reproduce
- Transcribe
- Reduce
- Increase
- Figure
- Conduct
- Compare

Demonstrate

- Show your work
- Show procedure
- Perform an experiment
- Perform the steps
- Operate
- Remove
- Replace
- Turn on/off
- (Dis) assemble
- (Dis) connect

Objectives and Competencies (continued)

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives which will fit the material to the needs of the students and community. When a teacher adds objectives, he/she should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. Duties of the instructor will vary according to the particular unit. However, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss unit and specific objectives and information sheet; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Information Sheet

The information sheet provides content essential for meeting the cognitive (knowledge) requirements of the unit. The teacher will find that the information sheet serves as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the unit objective.

Students should read the information sheet before the information is discussed in class. Students may take additional notes on the information sheet.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheet. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able to and in most situations should demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and teacher to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for a student to follow if he/she has missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances he/she might reasonably expect from a person who has had this training.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and can help the teacher spot difficulties being encountered by students in their efforts to accomplish the unit objective. Test items for objectives added by the teacher should be constructed and added to the test.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

Care of Materials

The cost of reproduction of this guide prohibits the replacement of these materials. Therefore, please be extremely careful in handling originals. Make the necessary copies of the information sheets, transparencies, assignments and tests and replace originals in the curriculum guide notebook. Take extra care in keeping originals clear for future reproduction.

CROP CHEMICALS
UNIT 13

UNIT OBJECTIVE

After completing this unit, the student should be able to discuss proper and improper use of pesticides and how they affect the environment; identify available formulations, calculate amounts of pesticide to apply, list and discuss factors that affect application of chemicals, and discuss safety practices in relation to prevention of accidents using crop chemicals. This knowledge will be shown by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with crop chemicals to the correct definitions.
2. List two functions of agricultural chemicals.
3. Name three main groups of pests.
4. Match the pesticide with the pest controlled.
5. Select from a list results of discontinued pesticide use.
6. Match EPA classification of pesticides to the correct definition.
7. Select from a list resources necessary for man to exist.
8. Name two ways pesticides are beneficial to the environment.
9. Name two ways improper use of pesticides can harm the environment.
10. Select from a list facts contained on a pesticide label.
11. Match signal words found on labels with the correct level of toxicity.
12. Match the herbicide classification with the correct description.
13. Match the types of formulations to the correct description.
14. Discuss advantages, disadvantages, and principal uses of two types of formulations.
15. Arrange in proper sequence the procedure for mixing wettable powders (dry).

OBJECTIVE SHEET

16. Arrange in proper sequence the procedure for mixing emulsifiable concentrates (liquid).

17. List four safety precautions when mixing and handling pesticides.

18. Calculate problems determining amounts of wettable powder (dry) to use.

19. Calculate problems determining amounts of emulsifiable concentrate (liquid) to use.

20. Match methods of pesticide application to the correct description.

21. Identify the parts of a sprayer.

22. Identify the type of nozzle by its spray pattern.

23. Name two climatic factors that affect pesticide application.

24. List four factors to consider when choosing appropriate pesticides.

25. Name the two causes of most pesticide poisonings.

26. List three ways pesticides enter the body.

27. List the most important routes of entry for applicators and small children.

28. List three steps to follow in case of pesticide poisoning.

29. Name the local hospital or poison control center that serves the area that can provide emergency treatment for pesticide poisoning.

30. Select from a list the protective clothing and equipment needed for pesticide applications.

31. Select from a list ways to prevent exposure during application.

32. Name four methods for disposal of pesticides and pesticide containers.

33. List four reasons for keeping records of pesticide use.

34. Interpret pesticide labels correctly when given questions concerning pests.

CROP CHEMICALS
UNIT 13

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit

      1. Literature

         a. Crop Chemicals, an FMO publication by John Deere; 9 chapters; order from John Deere Service Publications, Dept. F, John Deere Rd., Moline, IL, 62165.

         b. Weed Control, set of 61 transparencies; available from Vocational Agriculture Service, University of Illinois, 1401 S. Maryland, Urbana, IL, 61801; approximate cost $19.45.

         c. Field Sprayer Calibration, 21 transparency masters; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $2.25, order no. 503.

         d. Principles of Pesticide Use, Handling and Application, basic requirements for private applicator pesticide certification, available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402; approximate cost $5.90, stock no. 055-004-00012-9.

         e. Apply Pesticides Correctly: Instructors Manual, available from United States Environmental Protection Agency, National Audiovisual Center, Government Services Administration, Washington, D.C., 20409.

      2. Filmstrips, slideshows, etc.

         a. Crop Chemicals, slide set available from John Deere Service Publications, Dept. F, John Deere Rd., Moline, IL, 62165; approximate cost $112.00.

         b. Pesticides: Safe Handling and Use, 6 cassettes, 6 film strips and study guide; available from Teaching Aids, Inc., P. O. Box 1798, Costa Mesa, CA, 92626; approximate cost $229.00, order no. B260.

         c. Sprayer Calibration, 1 disk, transparency and handout masters; available from Teaching Aids, Inc.; approximate cost $22.00, order no. ACS-5.

SUGGESTED ACTIVITIES

d. Modern Agricultural Spraying Equipment, 54-frame filmstrip with script; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $8.75, order no. 331.

e. Pesticide Use Training, 420 slides with cassettes and scripts; available from United States Environmental Protection Agency, National Audiovisual Center, Government Services Administration, Washington, D.C., 20409.

f. Be a Pro with Pesticides, 72 slides with cassette and script; available from Visual Communications, 4125 Roberts Hall, Cornell University, Ithaca, NY, 14853. Used in conjunction with Be a Pro with Pesticides, 16mm film, 22 1/2 minutes, available from same address.

g. Be A Pro: Avoid Pesticide Accidents, 79 slides with cassette and script, available from Cornell University.

h. Proper Pesticide Use Series: Pesticides, color video cassettes available from Oregon State University, Corvallis, OR, 97331.

i. Applying Pesticides Properly, color video cassettes; available from Kansas State University, Manhattan, KS, 66506.

j. Agricultural Weed Control, 53-frame filmstrip; available from VEP, Cal Poly State University, San Luis Obispo, CA, 93407; approximate cost $27.50.

3. Films

B. Make transparencies

C. Provide students with objective sheet

D. Provide students with information and assignment sheet

E. Discuss unit and specific objectives

F. Discuss information and assignment sheets

SUGGESTED ACTIVITIES

G. Invite a resource person to visit with class concerning the importance of private pesticide applicator certification and applicable federal, state, and local laws and regulations

H. Ask students to clip magazine and newspaper articles which demonstrate ways that pesticides improve the environment

I. Ask students to list the pesticides on their farms and in their homes. Have them list them according to type, such as insecticide or herbicide

J. Invite local pest management specialist to speak to class about on-going projects. Ask the specialist to bring examples of natural enemies and beneficial plants and animals found in your area

K. Secure pesticide labels and make them available to students

L. Contact a trained medical person at the local hospital or poison control center that provides treatment for pesticide poisoning and ask the person to speak to class

M. Assemble the different types of respirators and demonstrate proper use, clean up and storage of each

N. Assemble the basic types of protective clothing and equipment. Give students a sample label, target pest, and application site and ask them to put on the necessary clothing and equipment for the job. Allow class to critique both over and under protection for the job

O. Provide student with opportunity to practice mixing pesticides by using flour for wettable powder and oil as an emulsifiable concentrate. Use water to dilute them. DO NOT USE ACTUAL PESTICIDES!

P. Borrow equipment from local dealers or farms and allow students to practice calibrating equipment

Q. Give test

R. Reteach if necessary

S. Retest

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

SUGGESTED ACTIVITIES

D. Transparency masters

1. TM 1--Pesticides and pest controlled
2. TM 2--Without pesticides
3. TM 3--Food chain or food web
4. TM 4--Existing pesticide label
5. TM 5--Signal words
6. TM 6--Selective vs nonselective herbicide
7. TM 7--Ways pesticides attack pests
8. TM 8--Preemergence and postemergence
9. TM 9--Types of formulations
10. TM 10--Proper mixing
11. TM 11--Proper clothing for mixing
12. TM 12--Storage area
13. TM 13--Methods of application
14. TM 14--Types of pesticide application equipment
15. TM 15--Parts of a sprayer
16. TM 16--Types of nozzles
17. TM 17--Ways pesticides enter body
18. TM 18--Protective clothing and equipment
19. TM 19--Container classification
20. TM 20--Disposal of containers
21. TM 21--Spray record sheet

E. Assignment sheets

1. AS 1--Interpret pesticide label
2. AS 2--Calculate spray materials using wettable powder
3. AS 3--Calculate spray materials using emulsifiable concentrate

SUGGESTED ACTIVITIES

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Farm Chemicals Handbook - 1979. Willoughby, OH. Meister Publishing Co.

B. Principles of Pesticide Use, Handling, and Application. Washington, D.C. United States Environmental Protection Agency: 1976.

C. Murray, G. "Plant Science 407: Crop Production," Class notes, Srping 1984, University of Idaho, Moscow, ID.

D. Chemical Weed Control. Oklahoma State Board for Vocational-Technical Education. Stillwater, OK. Oklahoma State University: Ag II, Unit VI.

E. Weed Control. Teaching Materials Center. Agriculture Education Department. College Station, Texas. Texas A & M University: Vo-Ag II, Unit IV-E.

F. Hughes, H.A. Crop Chemicals, 2nd edition. Moline, Illinois. John Deere Technical Services: 1982.

G. Anderson, W.P. Weed Science: Principles, 2nd edition. St. Paul, MN. West Publishing Co.: 1983.

H. Callihan, R. "Plant Science 338: Weed Control," class notes, Fall 1984, University of Idaho, Moscow, ID.

CROP CHEMICALS
UNIT 13

INFORMATION SHEET

I. Terms and definitions

A. Pesticide--Chemical or other substance that will prevent, repel, destroy, or control a pest or protect something from a pest

B. Tolerance--Maximum amount of pesticide which can legally remain on or in any food or feed crop at harvest or animal at slaughter

C. Certification--Recognition by certifying agency that a person is competent and thus authorized to use or supervise the use of restricted-use pesticides

D. Phytotoxicity--Causing injury to plant life

E. Hazard--Risk of danger; chance that injury or harm will come to the applicator, other persons, plants, or animals

F. EPA--Environmental Protection Agency

G. Organism--Any living thing

H. Pest--An unwanted organism

I. Weed--Any plant that interferes with human affairs

J. Drift--Movement of pesticide droplets or particles by wind and air currents

K. Target--Area, building, plant, animal, or pest intended to be treated with pesticide

L. Short-term (non-persistent)--Pesticide that breaks down almost immediately into non-toxic by-products

M. Residual (persistent)--Pesticide that remains in the environment for a fairly long time

N. Broad spectrum (non-selective)--Pesticide which is toxic to a wide range of pests

O. Selective--Pesticide which is more toxic to some types of plants or animals than to others

P. Active ingredient--That part of a pesticide product which will kill or control pests or prevent damage by them

INFORMATION SHEET

Q. LD_{50}--Lethal dose or amount of a pesticide which would kill half a large number of test animals if eaten or absorbed through the skin

(Note: The lower the LD value, the more poisonous the pesticide. LD stands for lethal dose.)

R. Oral--Through the mouth

S. Dermal--Absorbed through the skin

T. Inhalation--Breathed in through the lungs

U. Formulation--Mixture of one or more active ingredients with other materials needed to make a pesticide easy to store, handle, dilute, and apply

V. Compatible--Able to be combined with other pesticides and applied as a mixture without reducing their effectiveness

W. Dilute--To make a pesticide thinner or weaker by adding water, oil, or other materials

X. Calibration--Measurement of how much pesticide will be applied by the equipment to the site; measurement of the delivery rate

II. Functions of agricultural chemicals

A. Improve crop growth

B. Protect crop against pests

III. Main groups of pests

A. Insects

B. Mites, ticks, and spiders

C. Bacteria, fungi and viruses

(Note: The plant disease is not the pest; the causal agent is.)

D. Nematodes

E. Vertebrate animals, i.e. rodents, coyotes, squirrels, etc.

F. Weeds

INFORMATION SHEET

IV. Pesticides and pest controlled

   A. Herbicides--Control weeds

   B. Insecticides--Control insects

   C. Fungicides--Control fungal diseases

   D. Bactericides--Control bacterial diseases

   E. Nematicide--Control nematodes

   F. Acaricides--Control mites, ticks, and spiders

   G. Rodenticides--Control rats, mice and other rodents

V. Economic importance of pesticide use

   A. Large quantity used each year

   (Note: In 1980, 846 million pounds of pesticide active ingredient were used on U.S. farms--about .81 pounds per acre. These materials cost $3.6 billion, approximately $16 for every person in the U.S.)

   B. Without the use of pesticides

      1. Yields would be reduced

      2. Food would be more expensive

      3. Food would be less available

      4. Food would be of lower quality

      5. Labor requirements would increase

      6. Exports would decrease

      7. Lower standard of living

      8. More of work force involved in food production

VI. EPA classifications of pesticides

   (Note: EPA will classify the use of each pesticide as either general or restricted.)

   A. General use--Pesticide use which will not cause excessive damage in the environment or endanger the applicator or other persons when applied according to label directions

INFORMATION SHEET

(Note: No certification requirements are necessary on the part of the applicator.)

B. Restricted use--Pesticide use which may cause damage in the environment or endanger the applicator or other persons unless label directions are followed

(Note: Certification is necessary on the part of the applicator to purchase and apply restricted use pesticides.)

VII. Resources necessary for man to exist

(Note: The surroundings in which man lives and the resources he depends on make up his environment.)

A. Place to live

B. Clean water

C. Clean air

D. Food

E. Clean soil

VIII. Ways pesticides are beneficial to the environment

A. Enable more food to be produced on same area

B. Control plant diseases, parasites, insects, and weeds

C. Control animal diseases, parasites, and insects

D. Preserve outdoor activities

IX. Ways improper use of some pesticides might harm the environment

A. Cause nature imbalance

B. Pollute streams and water supply

C. Pollute crops

D. Pollute soil

E. Injure desirable plants

F. Persistent residues in food chain

(Note: For more information on chemicals and the environment, contact your local office of the Environmental Protection Agency.)

INFORMATION SHEET

X. Facts contained on a pesticide label

   A. Name and address of chemical company

   B. Brand (trade) name

   C. Name and amounts of all active ingredients

      (Note: The label will also list the amounts of inert ingredients)

   D. Type of pesticide

   E. Kind of formulation

   F. EPA registration and establishment numbers

   G. Storage and disposal precautions

   H. Hazard statement

      (Note: This statement describes environmental hazards, human hazards, animal and plant hazards, and physical and chemical hazards.)

   I. Directions for use

   J. Net content

   K. Words: "Keep Out of Reach of Children"

   L. Signal word

   M. Days to harvest or slaughter

   N. Reentry interval, if applicable

   O. General use or restricted use classification statement

XI. Signal words found on labels

   A. Danger--Highly toxic pesticides; the word "poison" printed in red and the skull and crossbones symbol are also required on labels of highly toxic pesticides

   B. Warning--Moderately toxic pesticides

   C. Caution--Slightly toxic to relatively non-toxic pesticides

INFORMATION SHEET

XII. Classification of herbicides

A. Selectivity

1. Selective--Use to control weeds wthout significant damage to the crop

2. Nonselective--Kill all plants if applied at adequate rates

B. Mode of action

1. Contact--Kills only part of plant to which it is applied; not translocated

2. Systemic--Absorbed by roots and foliage and translocated throughout plant; kills entire plant

C. Time of application

1. Preplant--Applied to soil before crop is planted

2. Preemergence--Applied to soil prior to emergence but after the crop is planted

3. Postemergence--Applied after emergence to the crop or weed

XIII. Types of pesticide formulations

A. Granule (G)--Ready-to-use dry mixture of a small amount of active ingredient and inert carriers with all particles larger than dust particles

B. Emulsifiable concentrate (EC or E)--Solution which contains a high concentration of active ingredient which should be mixed with water; may contain from one to several pounds of active ingredient per gallon of concentrate

C. Flowable (F)--Very finely ground solid material which is suspended in a liquid; usually contains a high concentration of active ingredient and is mixed with water when applied

D. Wettable powder (WP or W)--Dry preparation which may contain a fairly high concentration (15%-95%) of active ingredient that dissolves in water to form a solution for application

E. Fumigant--Active ingredient is in the form of a gas or liquid which becomes gas when applied, and reaches the target as a gas

INFORMATION SHEET

XV. Advantages, disadvantages and principle uses of formulations

Formulation	Advantages	Disadvantages	Principle Uses
Granule	Ready to use; easy to apply; can be applied to target under dense foliage.	Limited foliage use	Soil treatment
Emulsifiable Concentrate	High concentration;relatively inexpensive; suitable for low pressure equipment with limited agitation	Easy to overdose; may be hazardous to applicator; phytotoxicity; requires agitation	Fruits and vegetables, farm animals field crops
Flowable (a pre-wetted powder)	Can be mixed with water; reduces nozzle clogging	Requires agitation	Fruits and vegetables; farm animals field crops
Wettable Powder	Relatively inexpensive; safer than emulsifiable con-centrate to use on tender foliage; easy to measure	May be hazardous to applicator; requires mechanical agitation; difficult to mix; may clog nozzles; dusty.	Fruits and vegetables; farm animals field crops
Fumigant	Toxic to wide range of pests; will penetrate crack sand crevices of grain	Area must be sealed; requires special protective equipment; dangerous	Inside buildings; greenhouses; farm stored grain; soil

XV. Procedure for mixing wettable powders

A. Fill tank one-half full of water

B. Start agitator

(Note: Keep agitator going at all times.)

C. Measure out correct amount of wettable powder

D. Add powder to a small amount of water in a clean mixing bucket

E. Stir until well mixed

(Note: This will make a "slurry", a watery mixture of insoluble matter.)

F. Add slurry to tank

G. Finish filling the tank

XVI. Procedure for mixing emulsifiable concentrates

A. Fill tank one-fourth to one-half full with water

B. Measure out correct amount of emulsifiable concentrate

C. Add EC directly into spray tank

D. Mix thoroughly using mechanical or hydraulic agitation

(Note: Do not use air agitation.)

E. Finish filling this tank

XVII. Safety precautions when mixing and handling pesticides

A. Follow all safety precautions stated on the label

B. Use protective clothing and equipment as stated on the label

C. Rinse empty containers and measuring cups to remove any residue

D. Read the label or consult an expert to make sure mixes of two or more pesticides are compatible

E. Avoid splashes, spills, and leaks

(Note: Clean up any splashes, spills, or leaks)

F. Wash all contaminated areas on clothing or equipment

G. Dispose of empty containers properly

XVIII. Determining amounts of wettable powder (dry) to use

A. Pounds per tank

1. Formula-- $\frac{\text{tank capacity}}{\text{gallons applied per acre}}$ X pounds per acre

2. Problem--Label calls for 3 pounds of 25% WP per acre. Your sprayer holds 50 gallons and applies 10 gallons per acre.

3. Solution-- $\frac{50}{10}$ X 3 = 15 pounds per 50 gallon tank

B. Pounds per gallon

1. Formula-- $\frac{\text{pounds of WP}}{\text{gallons water}}$ X tank capacity

2. Problem--Label calls for 2 pounds of 50% WP per 100 gallons of water. Your tank holds 300 gallons.

3. Solution-- $\frac{2}{100}$ X 300 = 6 lbs. per 300 gallons

C. Active ingredient per acre

1. Formula-- $\frac{\text{tank capacity}}{\text{gallons applied per acre}}$ x pounds WP per acre

2. Problem--A local expert recommends that you apply 1/2 pound of active ingredient per acre. You have a 50% WP on hand and your sprayer tank holds 50 gallons and applies 8 gallons per acre.

3. Solution--(Given: 1 pound of 50% WP per acre = 1/2 pound of active ingredient per acre)

   $\frac{50}{8}$ X 1 = 6.25 pounds of 50% WP per tank to apply 1/2 pound per acre.

XIX. Determining amounts of emulsifiable concentrate (liquid) to use

A. Pints per gallon

1. Formula-- $\frac{\text{Pints EC}}{\text{gallons of water}}$ X tank capacity

2. Problem--The label says to apply 1/4 pint of 8 EC per 100 gallons. Your tank holds 400 gallons. How much 8 EC is needed?

3. Solution--$\frac{1/4}{100}$ X 400 = 1 pint per 400 gallons

B. Pints, quarts, or gallons per acre

1. Formula--$\frac{\text{tank capacity}}{\text{gallons applied per acre}}$ X recommended amount of herbicide per acre

2. Problem--The label recommends that you apply 2 quarts of 6 EC per acre. Your sprayer holds 42 gallons and applies 6 gallons per acre..

3. Solution--$\frac{42}{6}$ X 2 = 14 quarts per tankful

C. Active ingredient per acre

1. Formula--$\frac{\text{tank capacity}}{\text{gallons applied per acre}}$ X amount EC per acre

2. Problem--A local expert recommends you apply 1/2 pound active ingredient per acre. You have a 4 EC on hand which contains 4 pounds of active ingredient per gallon formulation. Your sprayer holds 40 gallons and applies 6 gallons per acre. How much 4 EC is needed to apply 1/2 pound active ingredient per acre?

3. Solution--(Given: 4 pounds of active ingredient/gallon = 4 pounds per 4 quarts = 1 pound per quart = 1/2 pound per pint.)

   $\frac{40}{6}$ X 1 pint of 4 EC per acre = 6 2/3 pints per tankful

XX. Methods of application and their descriptions

A. Band--Application to a strip or band over or along each crop row

B. Broadcast--Uniform application to an entire specified area

C. Directed--Aiming the pesticide at a portion of a plant

D. Drench--Saturation of the soil with a pesticide

E. Foliar--Application to the leaves of a plant, shrub, or tree

F. In-furrow--Application to or in a furrow in which a crop is planted

G. Sidedress--Application along the side of a crop row

INFORMATION SHEET

H. Soil incorporation--Application to the soil followed by use of tillage implements to mix the pesticide with the soil

I. Spot treatment--Application to a small area

XXI. Parts of a sprayer

A. Pump

B. Pressure regulator and gauge

C. Control valves

D. Tank

E. Agitation system

F. Booms

G. Nozzles

XXII. Types of nozzles

A. Solid stream--Compact jet used in handguns to spray a distant target or fixed to apply a narrow band or to inject into the soil

B. Regular flat fan--Narrow oval pattern with lighter edges; used for broadcast spraying

C. Flooding flat fan--Wide angle spray pattern; used for broadcast spraying

D. Hollow cone--Circular pattern with little or no spray in the center; used for spraying foliage

E. Solid cone--Circular pattern (full); used for spraying foliage

XXIII. Climatic factors that affect pesticide application

A. Soil moisture

(Note: Pesticides work best with moderate soil moisture. Wetness may keep the pesticide from contacting the soil particles.)

B. Rain

(Note: Rain often causes pesticides to leach out of or run off the application site. It also may wash pesticides off foliage. However, pre-emergence herbicides and protectant or preventative fungicides are sometimes purposely applied just before or soon after rain.)

INFORMATION SHEET

C. Humidity

(Note: Herbicides work best when weeds are growing fast. High humidity and warm temperatures help cause this growth.)

D. Temperature

(Note: High temperatures cause some pesticides to evaporate more quickly than is desirable. Low temperatures may slow down or stop the activity of some pesticides.)

E. Light

(Note: Light aids in breaking down pesticides.)

XXIV. Factors to consider when choosing appropriate pesticide

A. Has directions on the label for the intended use

B. Is effective against the pest

C. Will not cause injury to the plant or other surface to which it is applied

D. Will cause the least damage to beneficial organisms

E. Will not move off the treated area and into environment to harm fish and wildlife

F. Works well in the machinery available

G. Is worth the cost

(Note: Cost of application should be compared to the increase in yield expected in the treated area.)

H. Toxicity to man, animals and other plants

XXV. Cause of most pesticide poisoning

A. Careless practices

B. Ignorance

(Note: Learn safe procedures; it is for your own good!)

XXVI. Ways pesticides enter the body

A. Oral

B. Dermal

C. Inhalation

INFORMATION SHEET

XXVII. Most important routes of entry for pesticides

A. Applicator--Dermal and inhalation

B. Small children--oral and dermal

(Note: You can be poisoned no matter which way the pesticide enters your body. It may enter and poison you through all three routes of entry at the same time.)

XXVIII. Steps to follow in case of pesticide poisoning

A. Check to see if patient is breathing

B. Call doctor or take victim to doctor or hospital

C. Locate pesticide label and have available for doctor

XXIX. Local hospital or poison control center that serves your area and that can provide emergency treatment for pesticide poisoning

A. City________________________Address______________________

B. Telephone: Area Code_____Number__________________________

(Note: Make sure your doctor has the number of the poison control center.)

XXX. Protective clothing and equipment needed for pesticide applications

(Note: Use protective clothing and equipment called for on the label.)

A. Gloves

1. Obtain unlined, elbow length neoprene or natural rubber gloves

(Note: Some chemicals will dissolve rubber or make it sticky.)

2. Make sure sleeves are outside your gloves

(Note: This should be done unless spraying overhead.)

3. Discard the gloves if any holes appear

4. Wash gloves with detergent and water before removing

   (Caution: Never use cotton or leather gloves unless specified on the label. These can be more hazardous than no protection at all because they hold the pesticide close to your skin.)

B. Coveralls

1. Wear clean tightly woven fabric coveralls that cover entire body or long sleeved shirt and long legged trousers

   (Note: Most applicators who apply pesticides regularly have special coveralls kept just for pesticide applications.)

2. Wear waterproof suit or apron when mixing highly toxic pesticides

3. Wear waterproof suit when you may be drenched during application

4. Wash clothes with detergent and water

C. Boots

1. Wear light weight, unlined neoprene or natural rubber boots

   (Note: Boots should cover your ankles.)

2. Put pant legs outside of boots

   (Note: This will keep pesticide from draining into boot.)

3. Wash and dry boots inside and out after each use

D. Goggles and face shield

1. Wear tight-fitting goggles or a face shield when pesticide spray or dust could get on your face or in your eyes

2. Wear goggles or face shield when pouring and mixing

3. Wash goggles and face shield after each use

INFORMATION SHEET

E. Head and neck covering

1. Protect hair and skin on neck from pesticide spray

2. Wear waterproof wide-brimmed hats or hard hats

(Note: In cool weather, a hooded waterproof parka and a bill cap are also good.)

XXXI. Ways to prevent exposure during application

A. Wear protective clothing and equipment

B. Do not wipe hands on clothing

(Note: Carry a special towel for wiping hands.)

(Caution: Do not wipe gloves on your clothing, especially if chemicals are on gloves. Your clothing can become contaminated and the chemicals may soak through to your skin.)

C. Never blow out clogged hoses, nozzles, or lines with your mouth

D. Never eat, drink, or smoke when handling pesticides

E. Work in pairs when handling hazardous pesticides or at least let someone know where you will be working

F. Keep persons, livestock and pets out of spray area

(Note: When working with pesticides day after day, even moderately toxic chemicals can poison you. Wear protective equipment, especially a respirator.)

(Caution: Do not let children or pets play around sprayers, dusters, filler tanks, storage areas, or old pesticide containers. Use proper rates. Overdose won't kill pest twice but may injure humans, crops, or wildlife.)

XXXII. Methods of disposal of pesticides and pesticide containers

A. Open burning

(Note: Check local regulations. In some areas burnable containers may be burned on the farm in small quantities, usually the amount emptied in one day. Never burn containers which held 2, 4-D type herbicides because the smoke could injure sensitive plants.)

INFORMATION SHEET

B. Burial

(Note: Many landfills will accept triple-rinsed pesticide containers, especially if broken, crushed, or cut apart. Otherwise, the burial site should be selected in an area where water will not be contaminated and where public health and the environment will not be harmed. Do not bury pesticides and unrinsed pesticide containers that contain mercury, lead cadmium, arsenic, or inorganic pesticides unless they are encapsulated. Some landfills will take these containers if they have been triple rinsed.)

C. Recycling

(Note: Some non-burnable containers, such as plastic and steel drums, may be returned to the manufacturer for reuse.)

D. Incineration in a special pesticide-approved incinerator

(Note: Some pesticides and pesticide containers may be made harmless using this method. However, this methods may not be used for pesticides or pesticide containers with mercury, lead, cadmium, arsenic, or inorganic pesticides.)

E. Chemical degradation

(Note: Sometimes pesticides can be chemically broken down into non-toxic materials. These methods are specific for each chemical and cannot be described here. Check with the manufacturer or local Environmental Protection Agency officials for specific methods.)

F. Soil injection

(Note: Use soil injection methods only when recommended by state or federal regulatory officials.)

G. Encapsulation

(Note: This is usually the only method of disposal of pesticides or unrinsed containers with mercury, lead, cadmium, arsenic, or inorganic pesticides.)

XXXIII. Reasons for keeping records of pesticide use

A. Help in finding an error if an error is made

B. Provide information to trace residue and/or damage problems

C. Help save money

INFORMATION SHEET

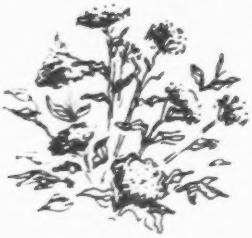
D. Allow one to compare the results obtained from different pesticides

E. Help to reduce pesticide misuse

F. Provide guide to buying specific amount of pesticide needed

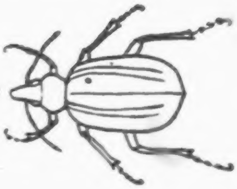
G. Establish proof of proper use in damage suit

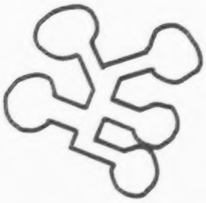
Pesticide and Pest Controlled



Herbicide

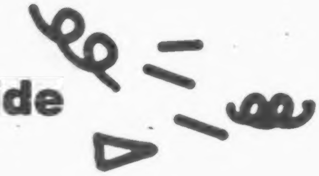
Insecticide

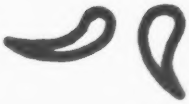




Fungicide

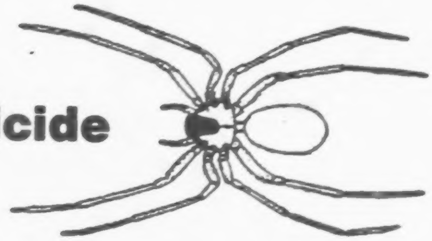
Bactericide

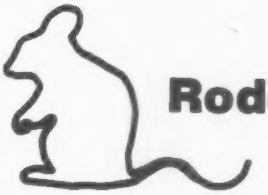




Nematicide

Acaricide



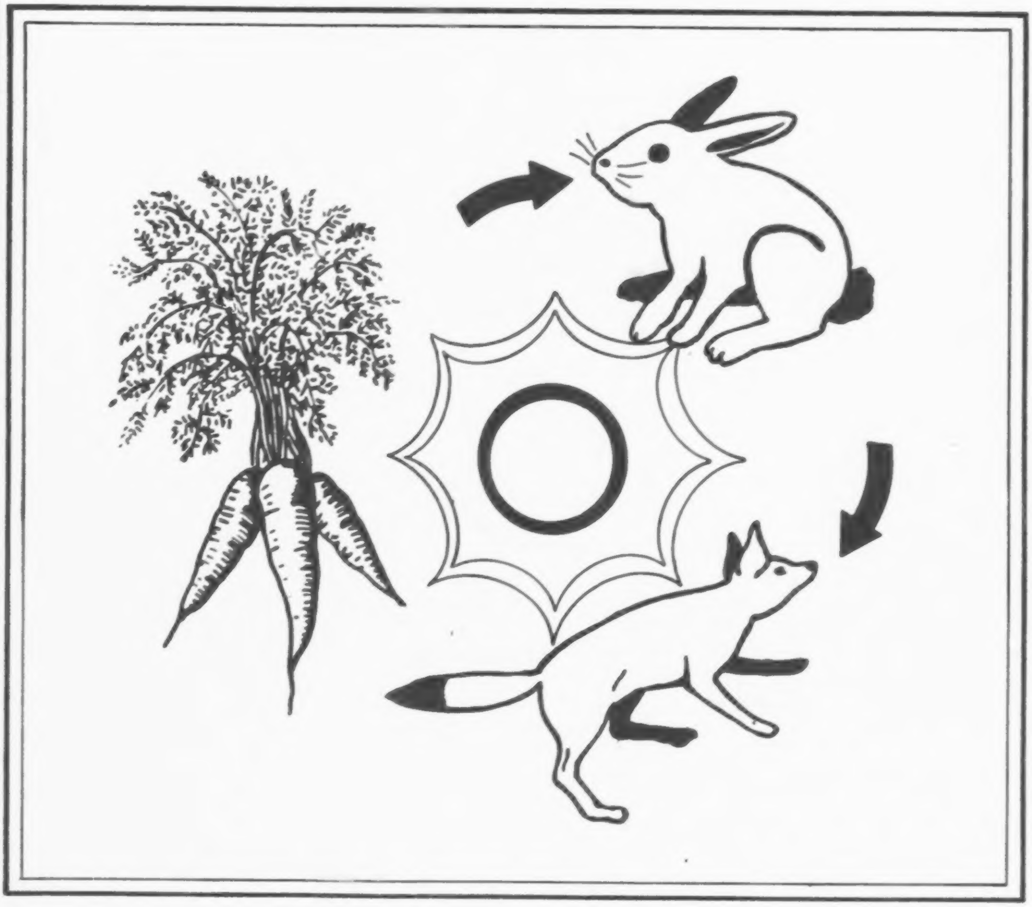


Rodenticide

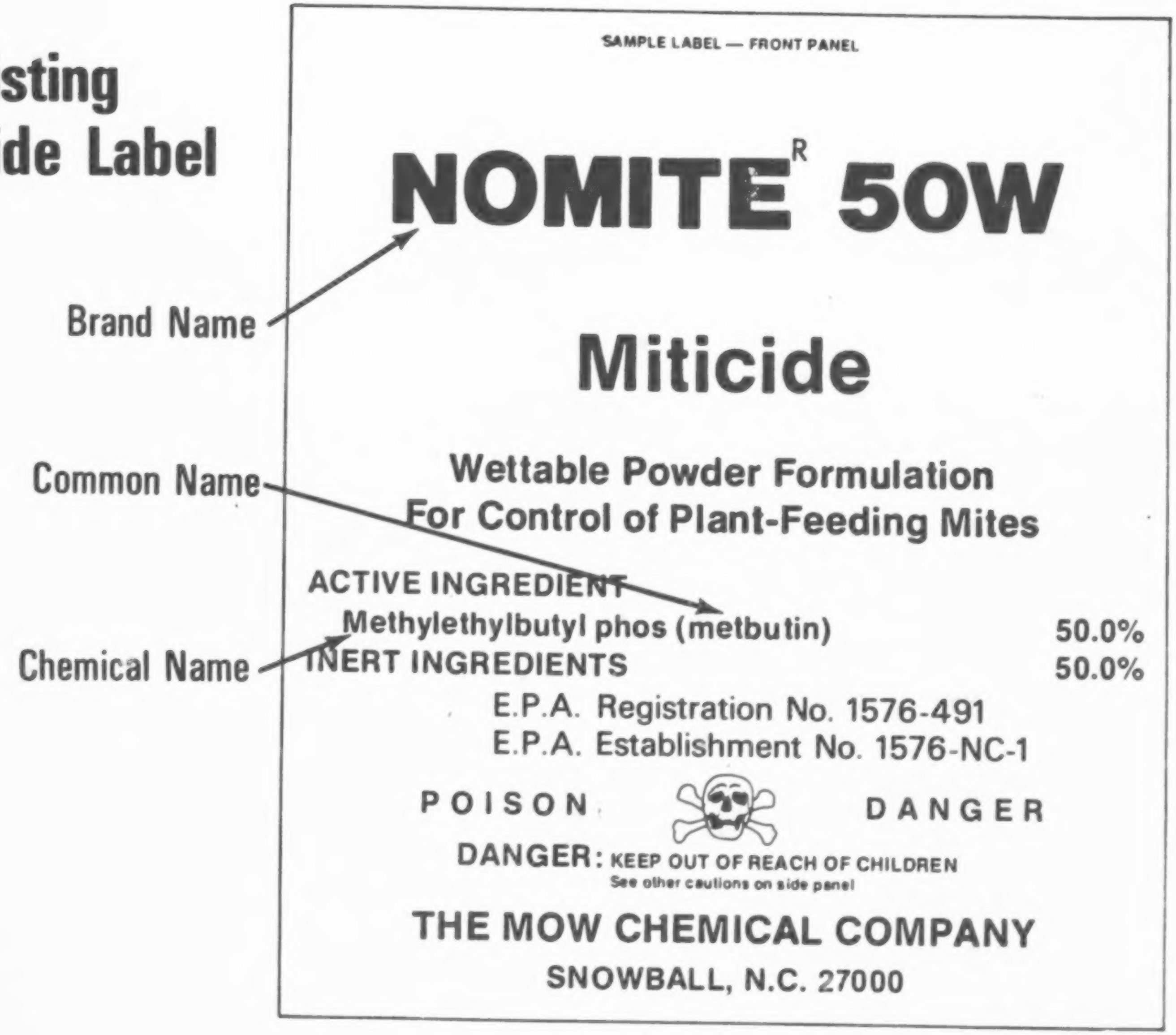
Without Pesticides

1. Yield would be reduced
2. Food would be more expensive
3. Food would be less available
4. Food would be of lower quality
5. Labor requirements would increase
6. Exports would decrease
7. Lower standard of living
8. More of work force involved in food production

Food Chain or Food Web



Existing Pesticide Label



Brand Name

Common Name

Chemical Name

SAMPLE LABEL — FRONT PANEL

NOMITE® 50W

Miticide

Wettable Powder Formulation
For Control of Plant-Feeding Mites

ACTIVE INGREDIENT
Methylethylbutyl phos (metbutin) 50.0%
INERT INGREDIENTS 50.0%

E.P.A. Registration No. 1576-491
E.P.A. Establishment No. 1576-NC-1

POISON DANGER

DANGER: KEEP OUT OF REACH OF CHILDREN
See other cautions on side panel

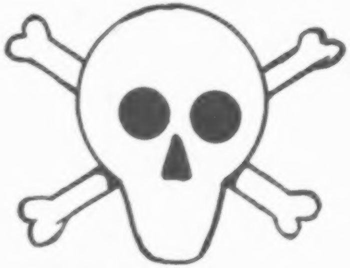
THE MOW CHEMICAL COMPANY
SNOWBALL, N.C. 27000

TM #4

CSS 13 28

Signal Words

DANGER



POISON

Highly Toxic

WARNING

Moderately Toxic

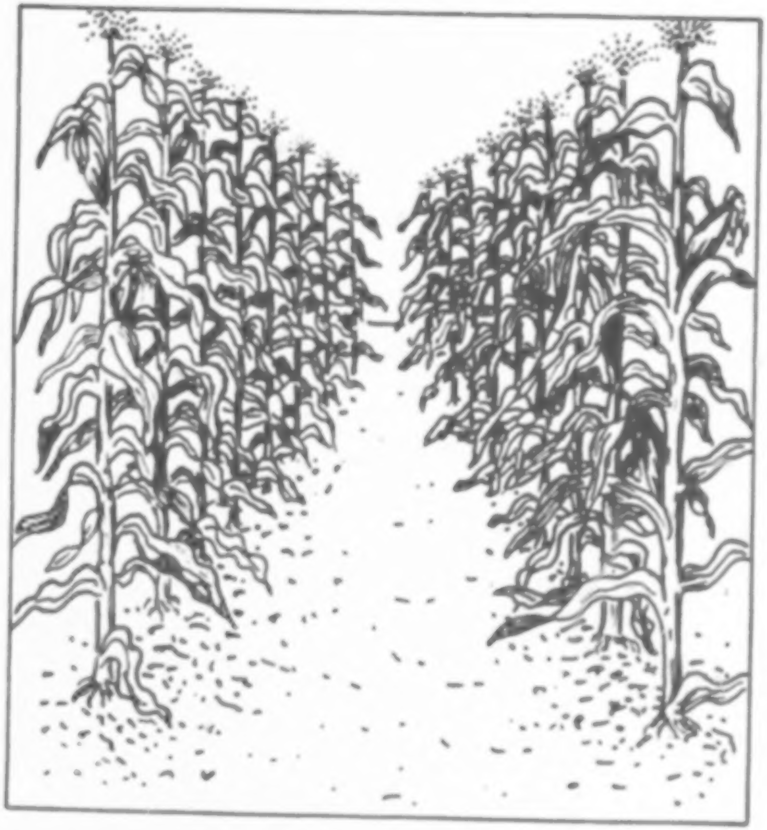
CAUTION

Slightly Toxic to
Relatively Nontoxic

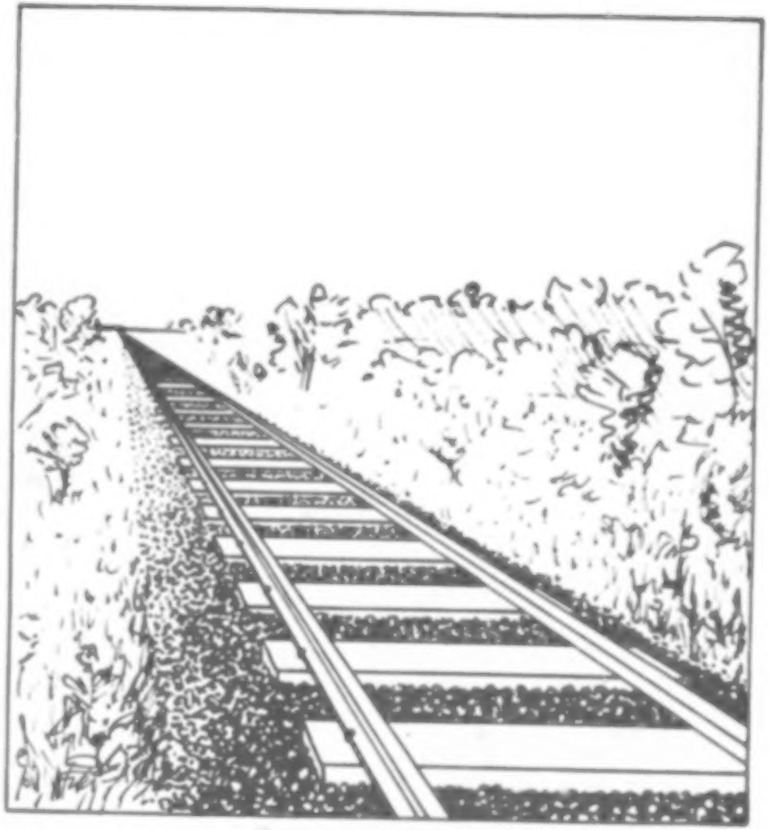
TM #5

CSS 13 29

Selective vs Nonselective Herbicide



Selective

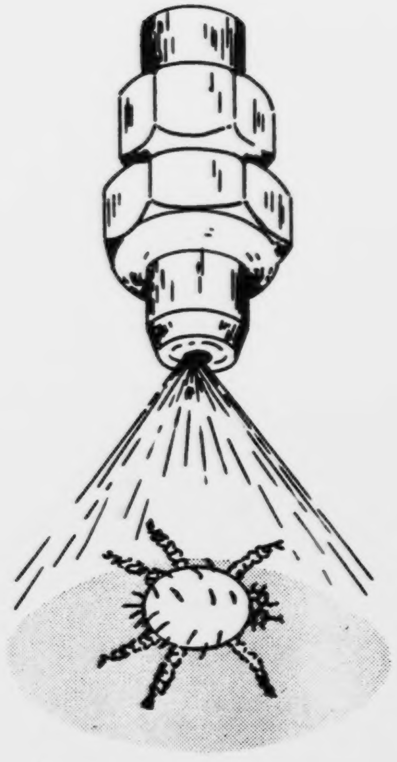


Nonselective

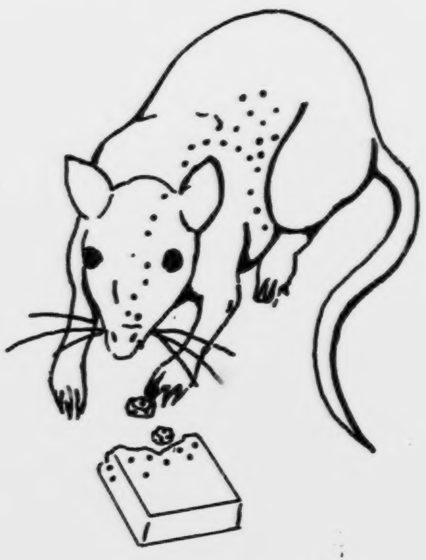
TM #6

CSS 13 30

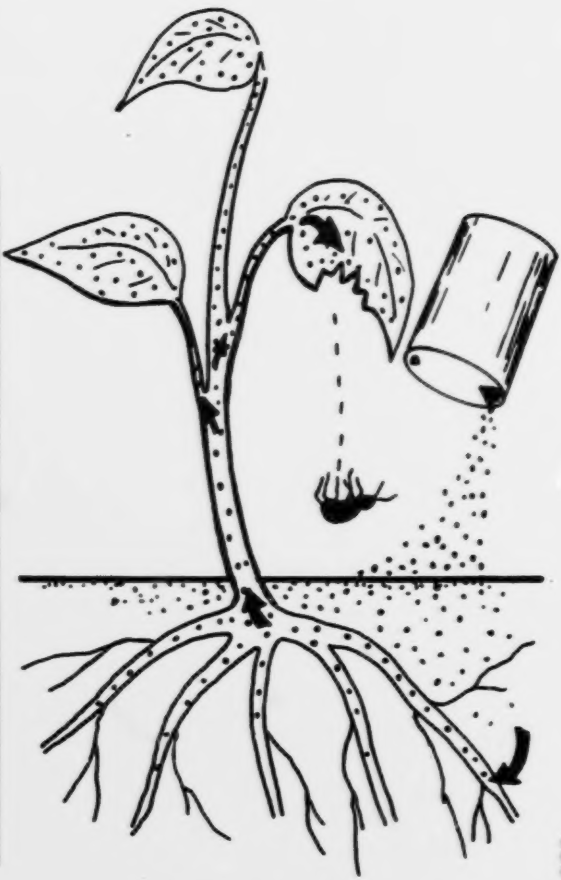
Ways Pesticides Attack Pests



Contact Poison

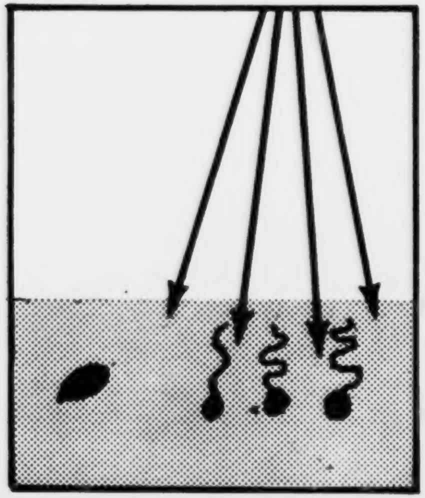


Stomach Poison

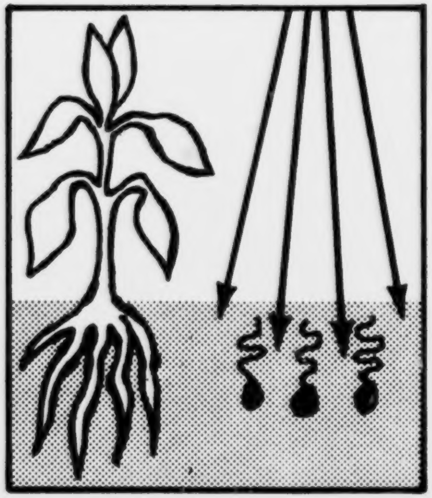


Systemic Poison

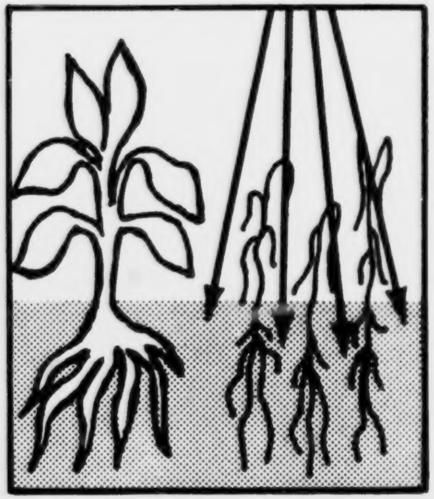
Preemergence and Postemergence



Preemergence to the Crop and Weeds



Postemerged Crop Preemerged Weeds



Postemergence to the Crop and Weeds

TM #8

CSS 13 32

Types of Formulations

Dry

Dust (D)

Poisonous Bait (B)

Granule (G)

Wettable Powder (WP or W)

Soluble Powder (SP)

Liquid

Low Concentrate Solution (S)

Emulsifiable Concentrate Solution (EC or E)

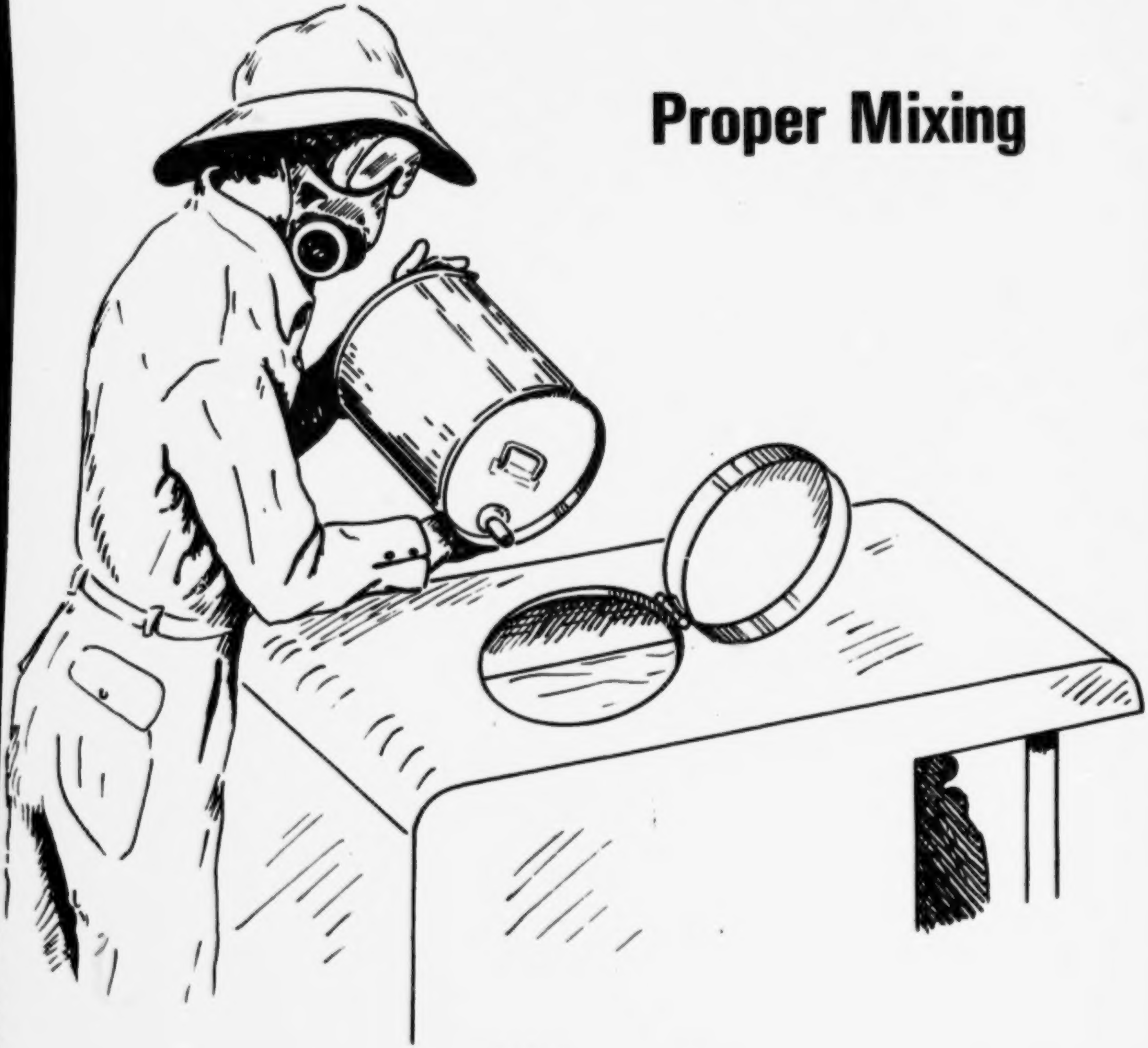
Ultra-Low Volume Concentrate Solution (ULV)

Flowable (F)

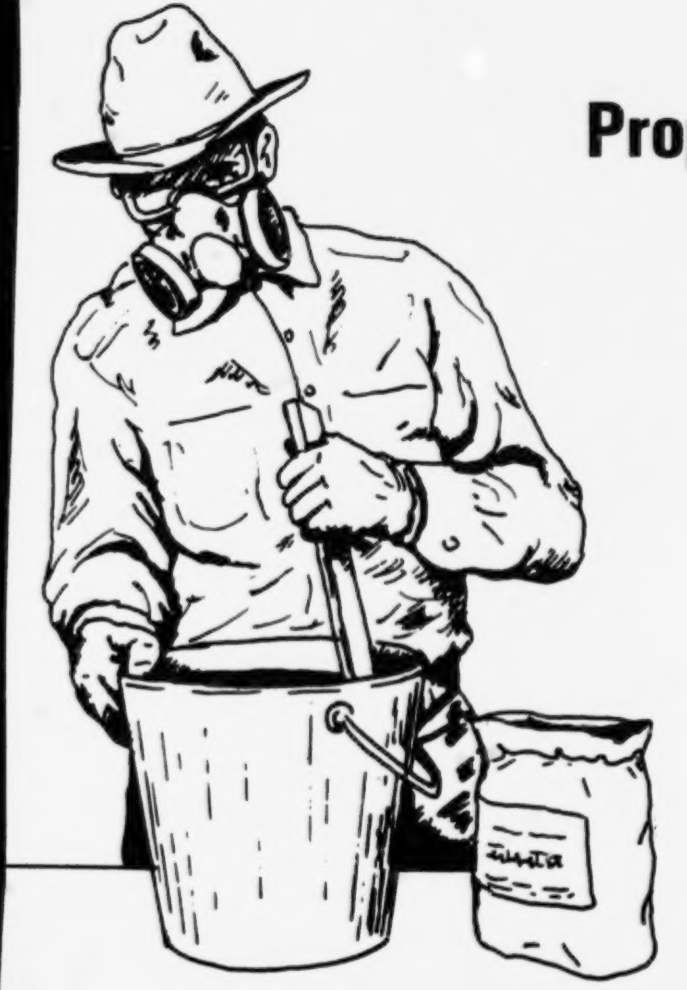
Gas

Fumigant

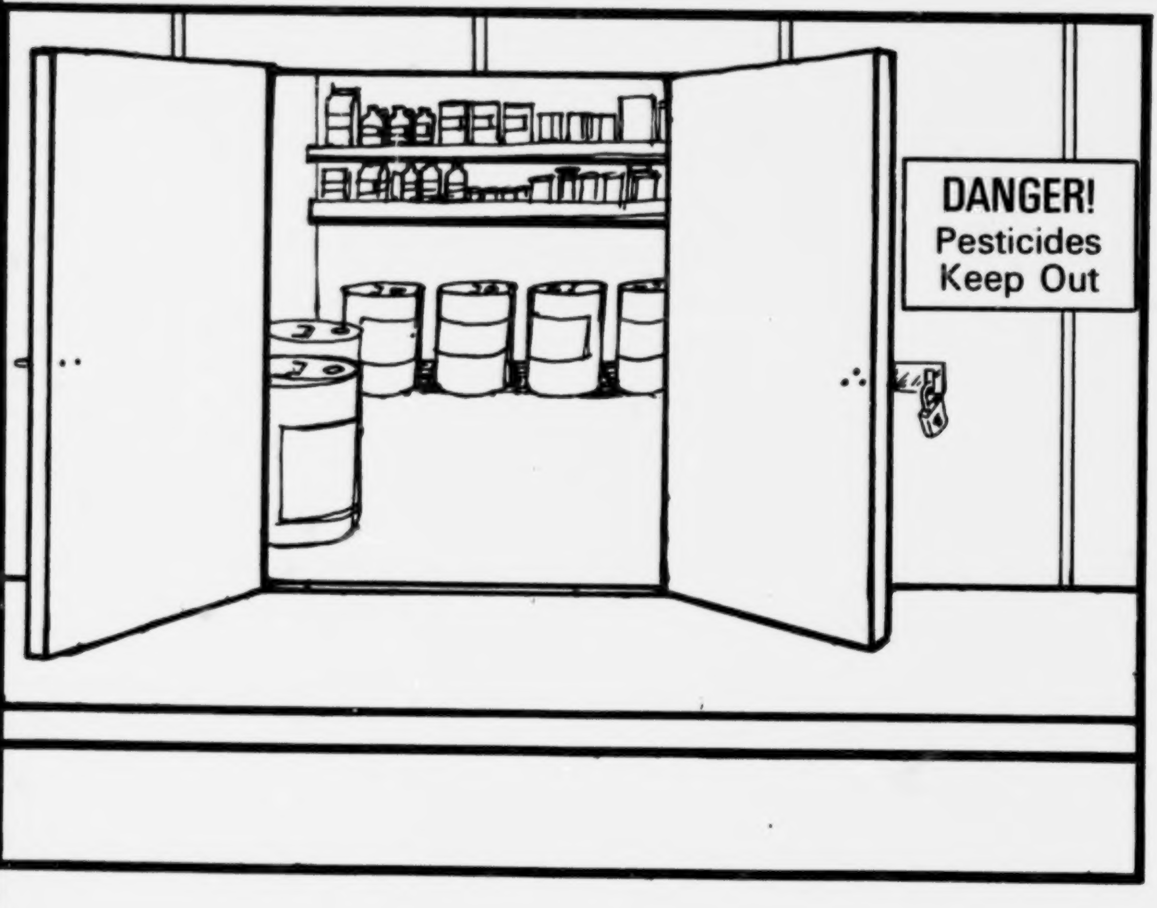
Proper Mixing



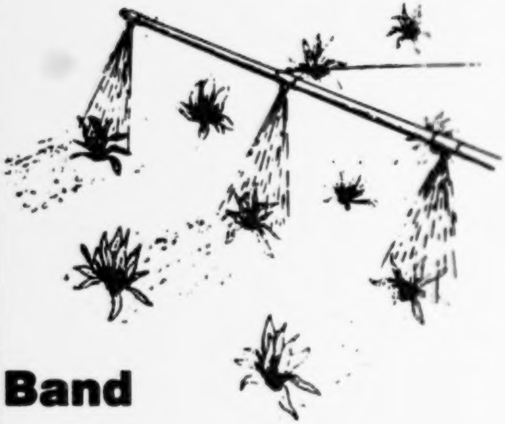
Proper Clothing for Mixing



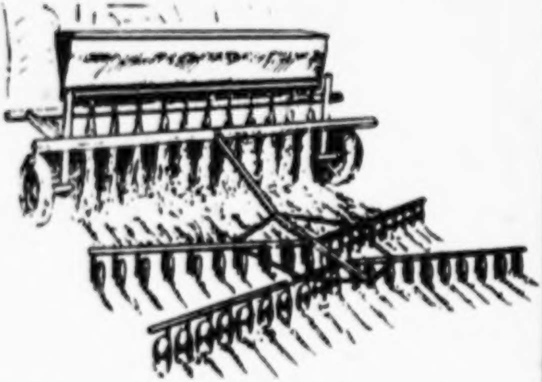
Storage Area


DANGER!
Pesticides
Keep Out

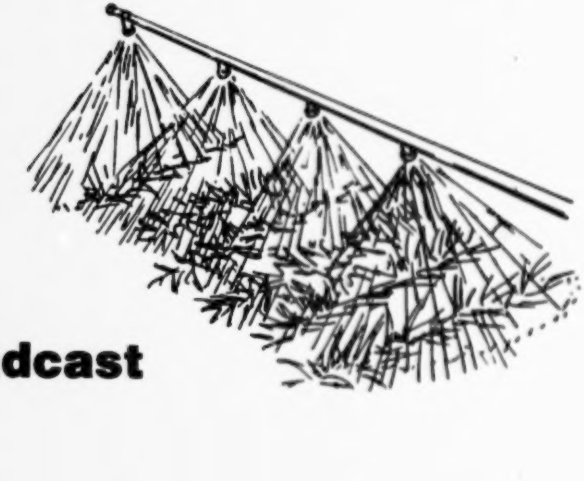
Methods of Application



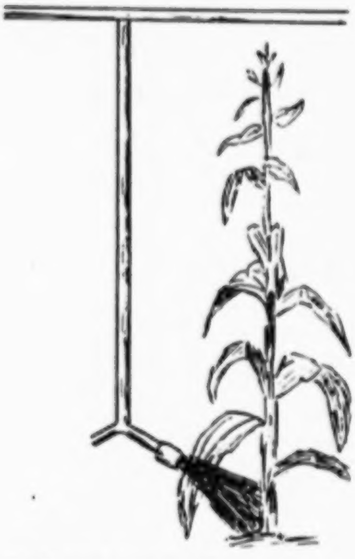
Band



Soil Incorporation

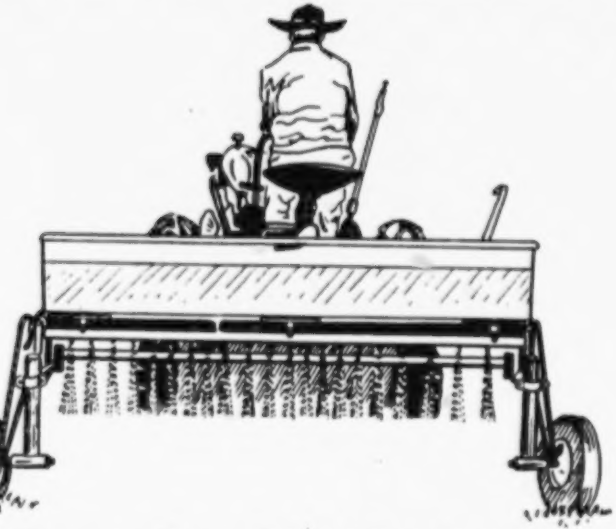


Broadcast

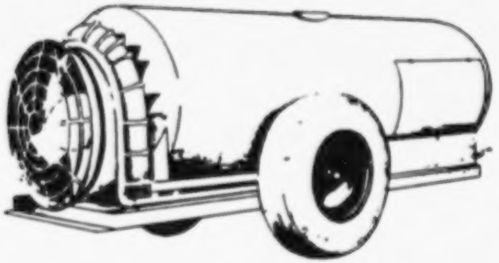


Directed

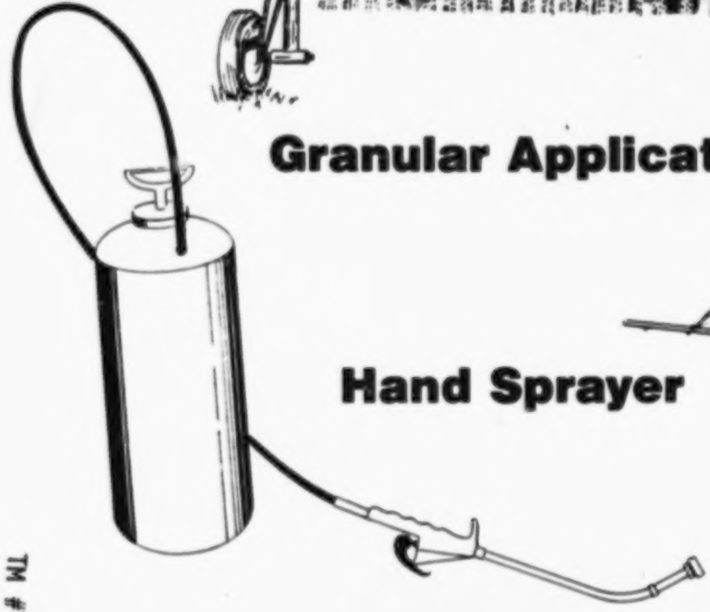
Types of Pesticide Application Equipment



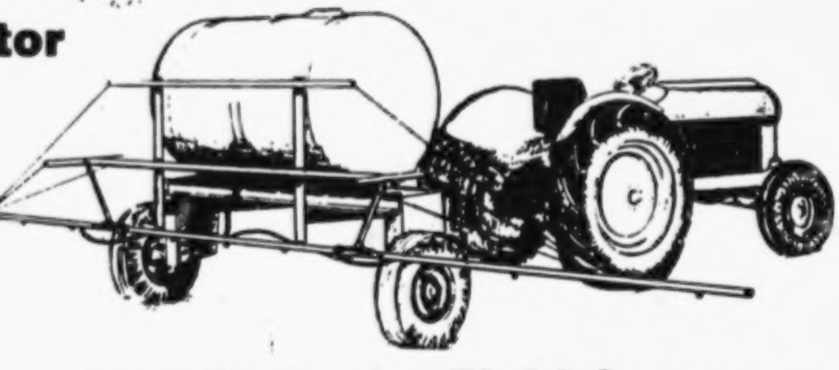
Granular Applicator



Air Blast Sprayer
or Mist Blower



Hand Sprayer

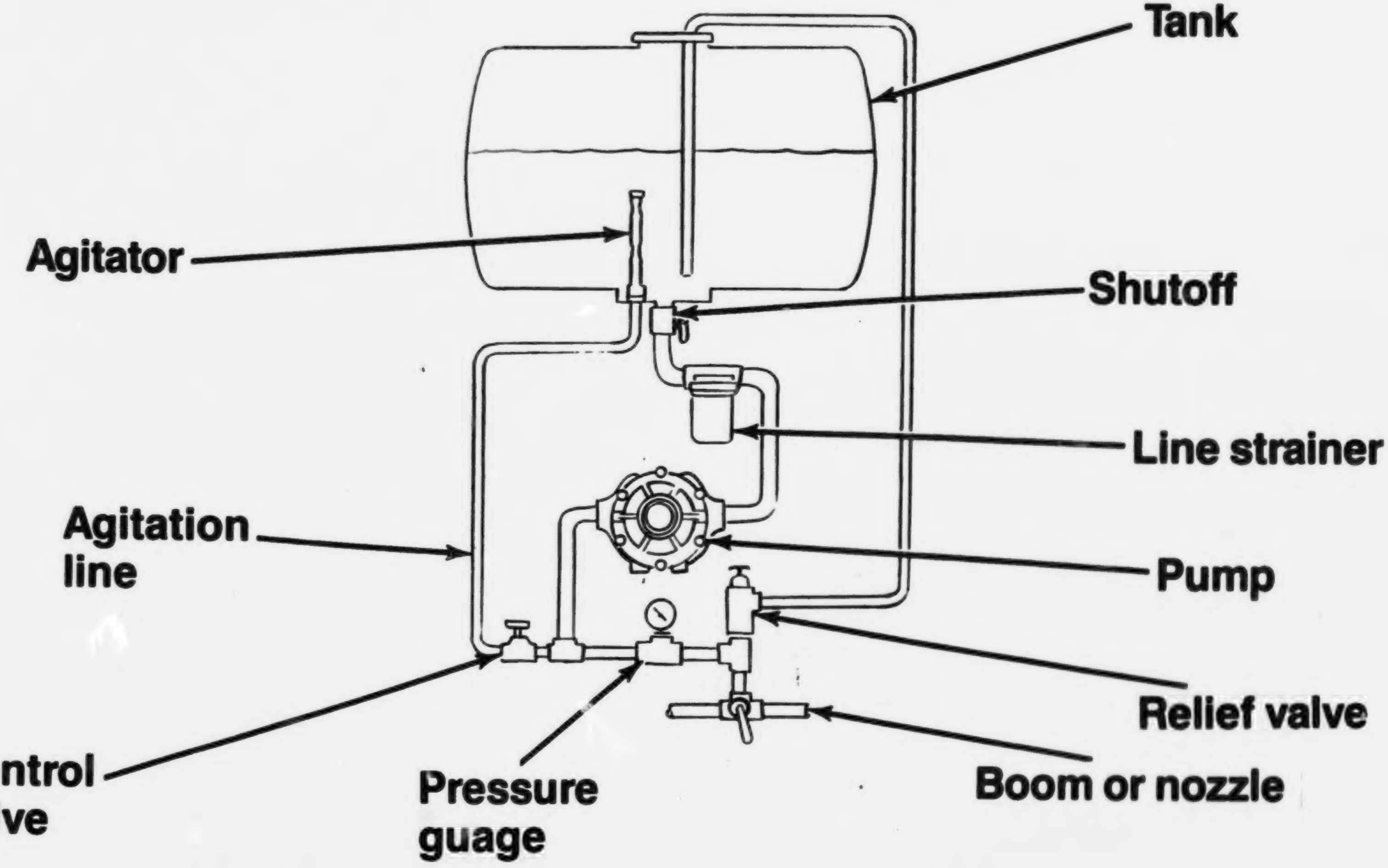


Low Pressure Field Sprayer

TM #14

CSS 13 38

Parts of a Sprayer

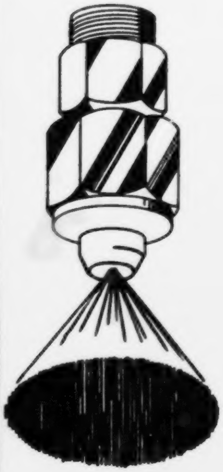

Tank
Agitator
Shutoff
Line strainer
Agitation line
Pump
Relief valve
Control valve
Pressure guage
Boom or nozzle

TM #15

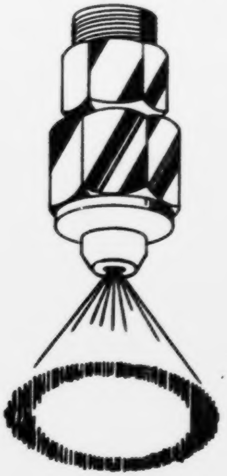
CSS 13 39

Types of Nozzles

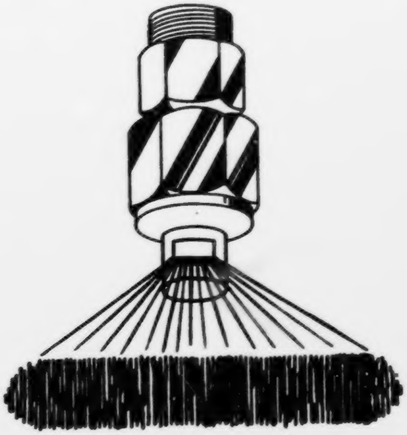
Solid (Full)
Cone Nozzle



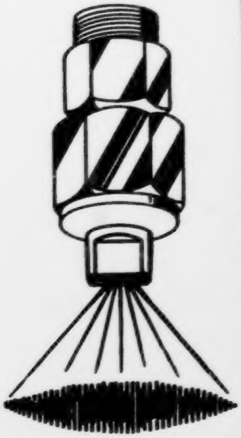
Hollow
Cone Nozzle

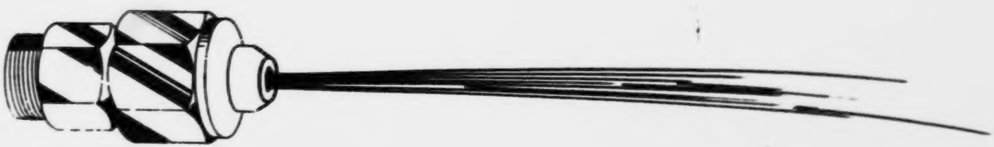


Flooding Flat
Fan Nozzle



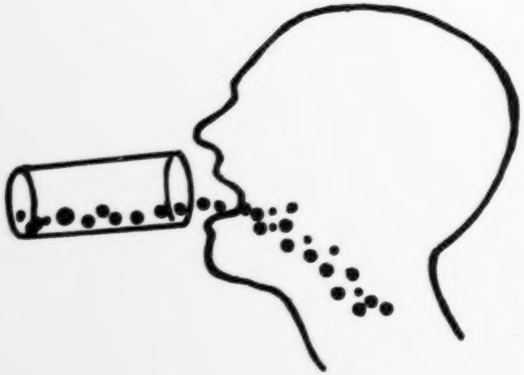
Regular Flat
Fan Nozzle



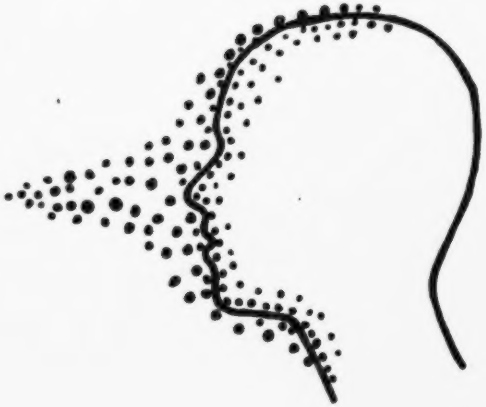


Solid Stream Nozzle

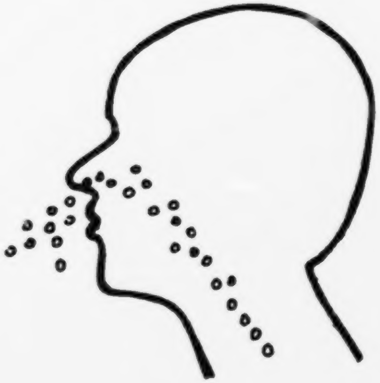
Ways Pesticides Enter Body



Oral



Dermal

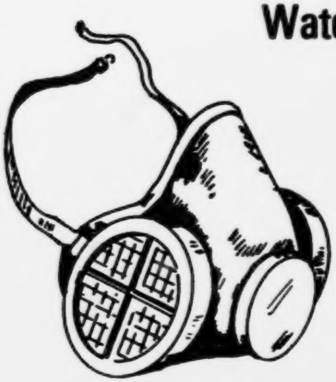


Inhalation

CSS 13 41

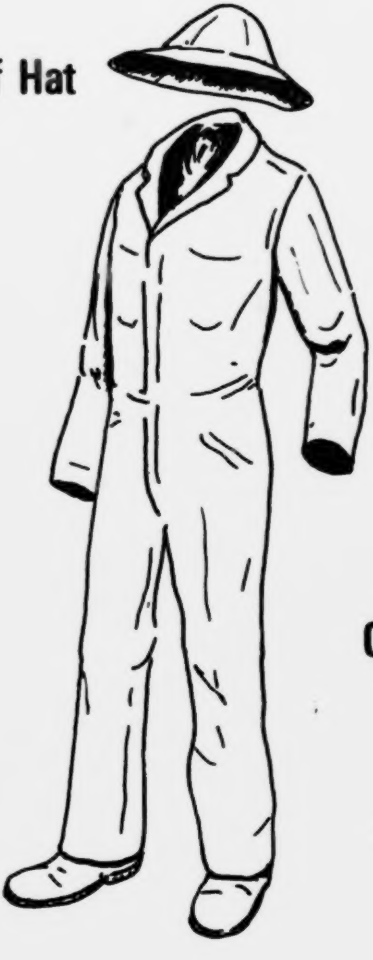
TM #17

Protective Clothing and Equipment



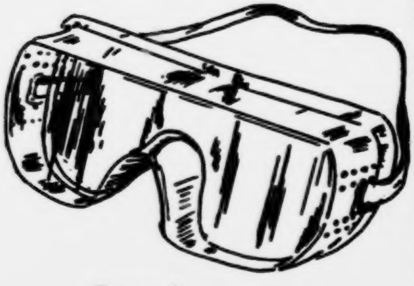
Respirator

Waterproof Hat

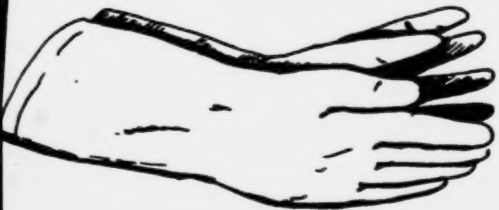


Closely Woven Fabric Coveralls

Rubber or Neoprene Boots



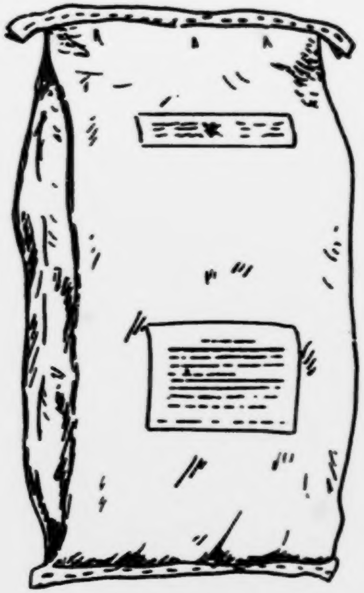
Goggles



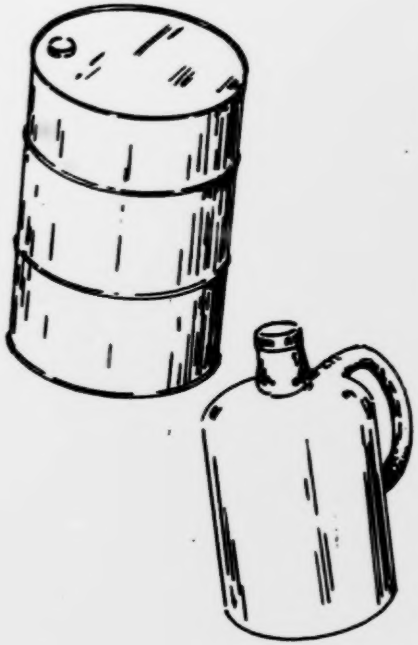
Long Rubber or
Neoprene Gloves

Container Classification

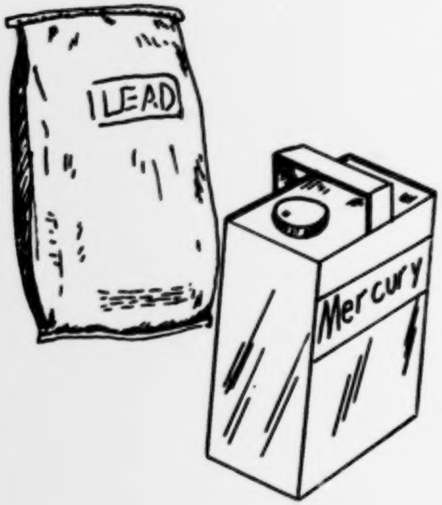
Burnable



Nonburnable



Mercury, Lead, Arsenic Cadmium and Inorganic Pesticides

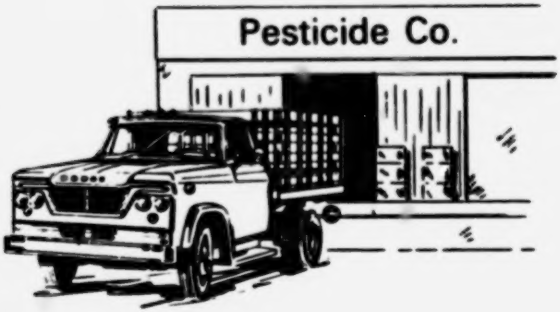


TM #19

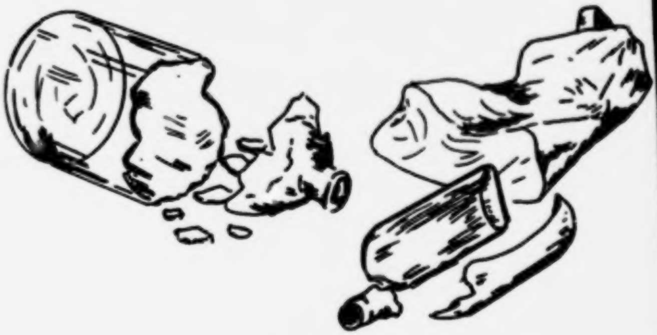
CSS 13 43

Disposal of Containers

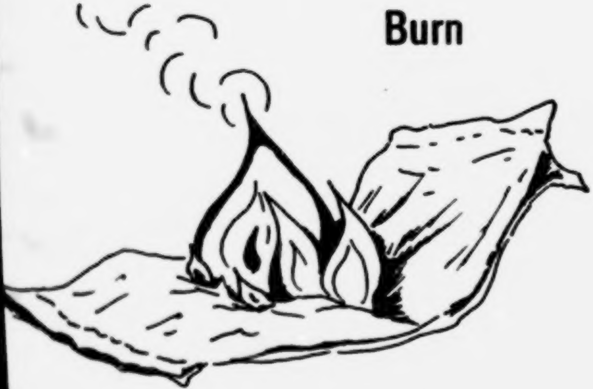
Recycling


Pesticide Co.

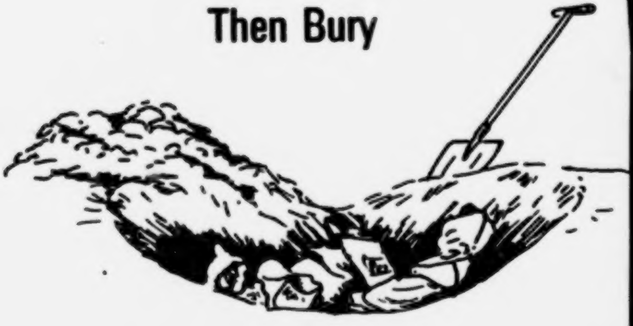
Break, Crush, or Cut Apart



Burn



Then Bury



Spray Record Sheet

Date and Time	Area or Target Treated and Pest	Equipment	Pesticide Name & Formulation, EPA Reg. Number, EPA Est. Number, & Rate (per acre, per 100 gallons, etc.)	Total Formulation Added To Tank or Hopper	Amount of Mixture Used	Amount Treated and Location	Additional Comments (Weather, applicator, severity of infestion, etc.)
5/12/73 3-5 PM	Smith's Alfalfa, Weevil	Lawrence Blower	Malathion Methoxychlor Double M, EC 3 qts./acre EPA Reg. #4625-329 EPA Est. #4625-NC-1	15 Gal.	50 Gal	20 acres Fields across the road from Jones	NE winds at 4 mph, sunny 70°, driver KAP, Alfalfa Weevil
5/14/73 7-9 pm	Smith's Calves, Lice	Root-Lowell	Ciovap 5 1 oz./animal EPA Reg. #3765-153 EPA Est. #3765-Ak-1	4 Gal.	4 Gal.	500 Calves	Lice on Calves, Calves 5 weeks old, condition good, #47 sick, Helper KAP

TM #21

CSS 13 45

CROP CHEMICALS
UNIT 13

ASSIGNMENT SHEET #1--INTERPRET PESTICIDE LABELS

NAME____ SCORE________________

Read the label provided on the following page and answer the questions below.

1. What type of pest does this pesticide control?
2. Is this a short-term (nonpersistent) or residual (persistent) pesticide? Why?
3. What type of formulation is DeMetho?
4. Who was the manufacturer?
5. What is the percentage of active ingredients?
6. How much pesticide does this container hold?
7. What signal word is on this label?
8. What toxicity category does it represent?
9. What protective clothing would you wear?
10. Does this formulation go on as is or must it be diluted? If diluted, with what?
11. How should you store this container?
12. How do you dispose of this container?

BEST COPY AVAILABLE

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS

(DANGER)

Poisonous by swallowing or inhalation. Do not breathe spray mist. Do not get in eyes. Avoid contact with skin. Use only when wearing the following protective equipment and clothing: Wear tightly woven cotton overalls, waterproof hat, unlined neoprene gloves and boots. Wear safety goggles and/or face shield. Wear a mask or respirator jointly approved by the Mining Enforcement and Safety Administration and by the National Institute for Occupational Safety and Health. Before removing gloves, wash them with detergent and water. Always wash hands, face and arms with detergent and water before smoking, eating or drinking. For emergency assistance, call 000 000 0000.

TO PHYSICIAN: De Metho is a reversible cholinesterase inhibitor. Do not use oximes such as 2-PAM. Give Atropine 2 mg. intravenously or subcutaneously [illegible]. Close supervision of the patient is indicated for at least 48 hours.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to wildlife and fish. Use with care when applying in areas frequented by wildlife or adjacent to any body of water. Keep out of lakes, streams or ponds. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from target area. Do not contaminate water by cleaning of equipment or disposal of wastes.

PHYSICAL OR CHEMICAL HAZARDS

Flammable: Keep away from heat and open flame.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

RE ENTRY STATEMENT (IF APPLICABLE)

Do not enter area within 24 hours after application.

CATEGORY OF APPLICATOR (IF APPLICABLE)

STORAGE AND DISPOSAL

STORAGE - Do not contaminate water, food, or feed by storage or disposal. Open dumping is prohibited. DISPOSAL - Pesticide, spray mixture, or rinsate that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies. Containers should be triple rinsed and offered for recycling, reconditioning, or disposed in approved landfill or buried in a safe place.
Consult Federal, State, or local Disposal authorities for approved alternate procedures.

RESTRICTED USE PESTICIDE

FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION

DE METHO

INSECTICIDE

Emulsifiable Concentrate

ACTIVE INGREDIENT: METHOMYL	24%
INERT INGREDIENTS:	76%
TOTAL:	100%

SPECIMEN

Net Content: 50 gallons

THIS PRODUCT CONTAINS 1.8 LBS OF DE METHO PER GALLON
DE METHO IS A REGISTERED TRADEMARK OF A-Z CORPORATION

KEEP OUT OF REACH OF CHILDREN

DANGER — POISON

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Induce vomiting by giving a tablespoonful of salt in warm water. Repeat until vomitus is clear. Call a physician im[illegible]

IF INHALED: Remove to fresh air. Call a physician immediately.

IF IN EYES: Flush eyes with plenty of water for at least 15 minu[illegible] physician immediately.

IF ON SKIN: In case of contact, remove contaminated clothing and wash skin with soap and water.

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

MFG BY A-Z CHEMICALS
PEST TOWN, VERMONT

ESTABLISHMENT NO. 1357 VT-1
EPA REGISTRATION NO. 1357-43

DIRECTIONS FOR USE CONTINUED

SPRAY PREPARATION

Fill spray tank 1/2 to 3/4 full of water. Add De Metho directly to spray tank and mix thoroughly, using mechanical or hydraulic means. Do not use air agitation.

APPLICATION

Apply at the recommended rates when insects first appear. Unless otherwise noted, continue applications at 5- to 7-day intervals or as needed. Use sufficient water (5-15 gals per acre by air) to obtain thorough, uniform coverage. Apply the low rates on small plants, small worms and light infestations of insects. Use intermediate rates on larger worms and heavier infestations of insects. Use 1 to 3 applications of the highest recommended rate for controlling severe infestations. Thereafter, use the lowest rate possible to maintain control.

NOTICE TO BUYER

Seller warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. This warranty does not extend to use of the product contrary to label use directions, or under abnormal use conditions, or under conditions not reasonably foreseeable to seller. Buyer assumes all risk of any such use. Seller makes no other warranties, express or implied.

Purchase of this material does not confer any rights under patents of countries outside of the United States.

CROP USAGE

CROPS [illegible]	INSECTS	RATE PER ACRE	LAST APPLICATION DAYS TO HARVEST	LAST APPLICATION DAYS TO LIVESTOCK GRAZING/FEEDING
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

CROP CHEMICALS
UNIT 13

ASSIGNMENT SHEET #2--CALCULATE SPRAY MATERIALS USING WETTABLE POWDER

Calculate the problems below and show your work.

1. How much wettable powder is needed to make 200 gallons of spray if recommended rate is 3 pounds per 50 gallons of water?

2. How many pounds of wettable powder are needed to make 100 gallons of spray if 3 pounds of 60% wettable powder is needed per acre and your sprayer applies 25 gallons per acre?

3. A farmer wants to spray a field of corn. The recommended strength of the spray is 0.5%. The wettable powder recommended is 50% and the spray tank holds 150 gallons. How much 50% WP is required for this mix?

$$\frac{\text{Gallons of spray wanted} \times \text{\% active ingredient needed} \times 8.3 \text{ pounds/gallon}}{\text{\% active ingredient in pesticide used}}$$

CROP CHEMICALS
UNIT 13

ASSIGNMENT SHEET #3--CALCULATE SPRAY MATERIALS USING EMULSIFIABLE CONCENTRATE

Calculate the problems below and show your work.

1. How many quarts of 6E are needed to mix 40 gallons if recommended amount is 2 quarts per acre and your sprayer applies 4 gallons per acre?

2. How many pints of 8EC are needed for 400 gallons of spray if recommended rate is 1/2 pint per 100 gallons of water?

3. A farmer wants to mix 200 gallons of 0.3% spray using 50% emulsifiable concentrate (4 pounds pesticide per gallon). How many gallons of concentrate will be needed?

$$\frac{\text{Gallons of spray wanted} \times \text{\% active ingredient} \times 8.3 \text{ pounds per gallon}}{\text{Pounds of active ingredient per gallon of concentrate} \times 100}$$

CROP CHEMICALS
UNIT 13

ANSWERS TO ASSIGNMENT SHEETS

ASSIGNMENT SHEET #1

1. Insects
2. Relatively short term; because it can be applied fairly close to harvest date and contains no other precautions on persistence
3. Emulsifiable concentrate
4. A-2 chemicals
5. 24%
6. 50 gallons
7. Danger (Poison, skull and crossbones)
8. Highly toxic
9. Closely woven fabric coveralls
10. Diluted with water
11. In original container in a dry, locked pesticide storage area away from food, feed, and livestock
12. Triple rinse, crush, and bury in a safe place or in a local landfill, if legal

ASSIGNMENT SHEET #2

1. 12 pounds
2. 12 pounds
3. 12.45 pounds or 12 1/2 pounds

ASSIGNMENT SHEET #3

1. 20 quarts
2. 2 pints
3. 1.25 gallons

CROP CHEMICALS
UNIT 13

TEST

NAME____ SCORE_________________

1. Match terms associated with crop chemicals to the correct definitions. Write the correct numbers in the blanks.

1. Pesticide
2. Tolerance
3. Certification
4. Phytotoxicity
5. Hazard
6. EPA
7. Organism
8. Pest
9. Weed
10. Drift
11. Target
12. Short-term
13. Residual
14. Broad spectrum
15. Selective
16. Active ingredient
17. LD_{50}
18. Oral
19. Dermal
20. Inhalation
21. Formulation
22. Compatible
23. Dilute
24. Calibration

_____a. Area, building, plant, animal, or pest intended to be treated with pesticide

_____b. Causing injury to plant life

_____c. Through the mouth

_____d. Measurement of how much pesticide will be applied by the equipment to the site

_____e. Environmental Protection Agency

_____f. Maximum amount of pesticide which can legally remain on or in any food or feed crop at harvest or animal at slaughter

_____g. An unwanted organism

_____h. Pesticide which is more toxic to some types of plants or animals than to others

_____i. Pesticide that remains in the environment for a fairly long time

_____j. Risk of danger; chance that injury or harm will come to the applicator, other persons, plants, or animals

_____k. Absorbed through the skin

_____l. Able to be combined with other pesticides and applied as a mixture without reducing their effectiveness

TEST

_____m. Any plant that interfers with human affairs

_____n. Lethal dose of a pesticide which would kill half a large number of test animals if eaten or absorbed through the skin

_____o. Any living thing

_____p. Chemical or other substance that will prevent, repel, destroy, or control a pest

_____q. Pesticide that breaks down almost immediately into non-toxic by-products

_____r. That part of a pesticide product which will kill or control pests or prevent damage by them

_____s. Breathed in through the lungs

_____t. To make a pesticide thinner by adding water, oil, or other materials

_____u. Mixture of one or more active ingredients with other materials needed to make a pesticide easy to store, handle, dilute, and apply

_____v. Recognition by certifying agent that a person is competent and thus authorized to use or supervise the use of restricted-use pesticides

_____w. Pesticide which is toxic to a wide range of pests

_____x. Movement of pesticide droplets or particles by wind and air currents

2. List two functions of agricultural chemicals.

a. ____

b. ____

3. Name three main groups of pests.

a. ____

b. ____

c. ____

TEST

4. Match the pesticide with the pest it controls. Write the correct numbers in the blanks.

1. Herbicide	5. Nematicide
2. Insecticide	6. Acaricide
3. Fungicide	7. Rodenticide
4. Bactericide	

_____a. Nematode

_____b. Spiders, ticks, and mites

_____c. Fungal infections

_____d. Plants; mainly weeds

_____e. Rats and mice

_____f. Flies, mosquito's, and other insects

_____g. Bacterial infections

5. Select from the following list results of discontinued pesticide use. Write and "X" in the blank before each correct answer.

_____a. Yields would increase

_____b. Food would be more expensive

_____c. Food would be more available

_____d. Food would be of lower quality

_____e. Labor requirements would decrease

_____f. More of work force involved in agriculture

_____g. Exports would increase

6. Match the EPA classification of pesticides to the correct definition. Write the correct numbers in the blanks.

1. General use   2. Restricted use

_____a. Pesticide use which will not cause excessive damage in the environment or endanger the applicator or other persons when applied according to label directions

_____b. Pesticide use which may cause damage in the environment or endanger the applicator or other persons unless label directions are followed

TEST

7. Select from the following list resources necessary for man to exist. Write an "X" in the blank before each correct answer.

_____a. High paying job

_____b. Clean water

_____c. Food

_____d. Companionship

_____e. Clean air

_____f. Shelter

8. Name two ways pesticides are beneficial to the environment.

a.____

b.____

9. Name two ways improper use of pesticides can harm the environment.

a.____

b.____

10. Select from the following list facts contained on a pesticide label. Write an "X" in the blank before each correct answer.

_____a. Name of manufacturer

_____b. Active ingredient

_____c. Formulation

_____d. Pest controlled

_____e. Storage and disposal precautions

_____f. Net content

_____g. Signal word

_____h. Directions for use

TEST

11. Match signal words found on labels with the correct toxicity level. Write the correct numbers in the blanks.

1. Danger
2. Warning
3. Caution

_____a. Slightly toxic to relatively non-toxic pesticides

_____b. Moderately toxic pesticides

_____c. Highly toxic pesticides

12. Match the herbicide classification with the correct description. Write the correct numbers in the blanks.

1. Selective
2. Nonselective
3. Contact
4. Systemic
5. Preplant
6. Preemergence
7. Postemergence

_____a. Kills only part of plant to which it is applied; not translocated

_____b. Applied to soil before crop is planted

_____c. Absorbed by roots or foliage and translocated throughout plant

_____d. Kills all plants present if applied at an adequate rate

_____e. Applied after emergence of the crops or weeds

_____f. Applied prior to emergence but after crop planting

_____g. Used to kill weeds without significant damage to crop

13. Match the types of pesticide formulations to the correct description. Write the correct numbers in the blanks.

1. Granule
2. Emulsifiable concentrate
3. Flowable
4. Wettable powder
5. Fumigant

_____a. Very finely ground solid material which is suspended in a liquid; usually contains a high concentration of active ingredient and is mixed with water when applied

_____b. Dry preparation which may contain a fairly high concentration of active ingredient that dissolves in water to form a solution for application

TEST

_____c. Solution which contains a high concentration of active ingredient which should be mixed with water

_____d. Active ingredient is in the form of a gas or liquid which becomes gas when applied, and reaches the target as a gas

_____e. Ready-to-use dry mixture of a small amount of active ingredient and inert carriers with all particles larger than dust particles

14. Discuss the advantages, disadvantages, and principal uses of two types of formulations.

____

____

____

____

____

____

____

____

____

15. Arrange in proper sequence the procedure for mixing wettable powders. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Measure out correct amount of wettable powder

_____b. Start agitator

_____c. Finish filling the tank

_____d. Stir until well mixed

_____e. Fill tank one-half full of water

_____f. Add slurry to tank

_____g. Add powder to a small amount of water in a clean mixing bucket

TEST

16. Arrange in proper sequence the procedure for mixing emulsifiable concentrates. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Add EC directly into spray tank

_____b. Measure out correct amount of EC

_____c. Mix thoroughly using mechanical or hydraulic agitation

_____d. Fill tank one-fourth to one-half full with water

_____e. Finish filling tank

17. List four safety precautions when mixing and handling pesticides.

a.____

b.____

c.____

d.____

18. Calculate the following problem to determine the amount of wettable powder to use. Use the following formula and show your work.

$$\frac{\text{Gals spray needed} \times \text{\% active ingredient wanted} \times 8.3\# \text{ per gallon water}}{\text{\% active ingredient in pesticide used}}$$

Problem: A local expert recommended using a 0.2% spray. You have on hand a 50% wettable powder of the right pesticide and you need 75 gallons of the spray. How much pesticide is needed?

TEST

19. Calculate the problem below determining the amount of emulsifiable concentrate to use. Show your work.

Problem: The label recommends using 3 pints per acre of 6E. Your sprayer holds 60 gallons and applies 6 gallons per acre. How much 6E is needed?

20. Match methods of pesticide application to the correct description. Write the correct numbers in the blanks.

1.	Band	6.	In-furrow
2.	Broadcast	7.	Sidedress
3.	Directed	8.	Soil incorporation
4.	Drench	9.	Spot treatment
5.	Foliar		

_____a. Uniform application to an entire specified area

_____b. Saturation of the soil with a pesticide

_____c. Application to or in a furrow in which a crop is planted

_____d. Aiming the pesticide at a portion of a plant

_____e. Application along the side of a crop row

_____f. Application to a small area

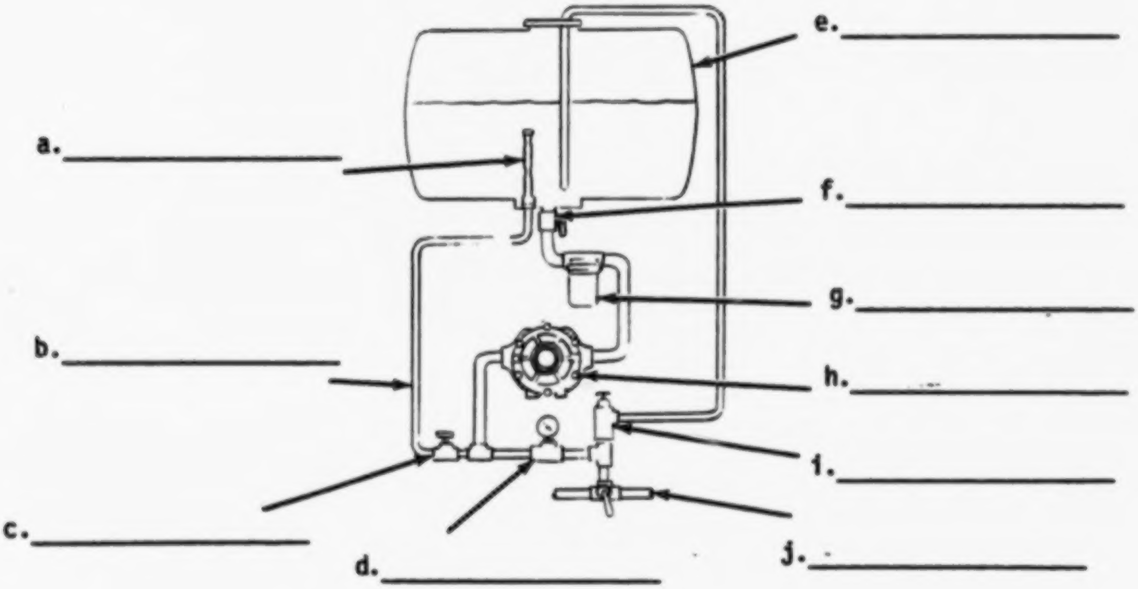
_____g. Application to a strip over or along each crop row

_____h. Application to the leaves of a plant

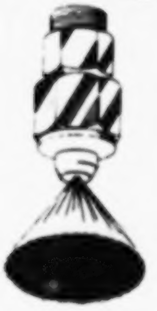
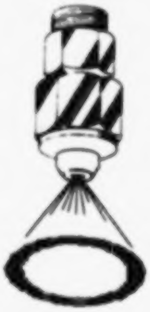
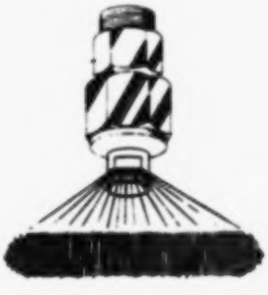
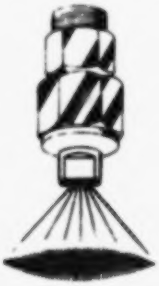
_____i. Application to the soil followed by use of tillage implements to mix the pesticide with the soil

TEST

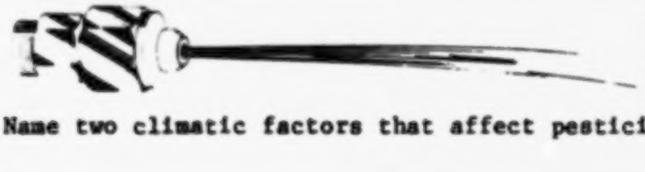
21. Identify the parts of a sprayer. Write the correct names in the blanks.



22. Identify the type of nozzle by its spray pattern. Write the correct names in the blanks.

a.____________ b.____________ c.______________ d.______________



e.______________

23. Name two climatic factors that affect pesticide application.

a.____

b.____

TEST

24. List four factors to consider when choosing the appropriate pesticide.

    a.____

    b.____

    c.____

    d.____

25. Name the two causes of most pesticide poisoning.

    a.____

    b.____

26. List three ways pesticides enter the body.

    a.____

    b.____

    c.____

27. List the most important routes of entry for:

    a. Applicators______________________________

    b. Small children____________________________

28. List three steps to follow in case of a pesticide poisoning.

    a.____

    b.____

    c.____

29. Name the local hospital or poison control center that serves your area and that can provide emergency treatment for pesticide poisoning.

TEST

30. Select from the following list protective clothing and equipment needed for pesticide application. Write an "X" in the blank before each correct answer.

_____a. Unlined, neoprene gloves

_____b. Tightly woven fabric coveralls

_____c. Unlined, neoprene boots

_____d. Tight fitting goggles or face shield

_____e. Waterproof hat

_____f. Waterproof suit when mixing highly toxic pesticides

31. Select from the following list ways to prevent exposure during application. Write an "X" in the blank before each correct answer.

_____a. Keep livestock out of spray area

_____b. Never eat, drink, or smoke when handling pesticides

_____c. Do not wipe hands on clothing

_____d. Work in pairs when handling hazardous pesticides

_____e. Never blow out clogged lines with your mouth

_____f. Wear protective clothing and equipment

32. Name four methods for disposal of pesticides and pesticide containers.

a. ____

b. ____

c. ____

d. ____

33. List four reasons for keeping records of pesticide use.

a. ____

b. ____

c. ____

d. ____

CROP CHEMICALS
UNIT 13

ANSWERS TO TEST

1. a. 11
   b. 4
   c. 18
   d. 24
   e. 6
   f. 2
   g. 8
   h. 15
   i. 13
   j. 5
   k. 19
   l. 22
   m. 9
   n. 17
   o. 7
   p. 1
   q. 12
   r. 16
   s. 20
   t. 23
   u. 21
   v. 3
   w. 14
   x. 10

2. a. Improve crop growth
   b. Protect against crop pest

3. Answer should include any three of the following

   a. Insects
   b. Mites, ticks, and spiders
   c. Bacteria, fungi, and viruses
   d. Nematodes
   e. Vertebrate animals
   f. Weeds

4. a. 5
   b. 6
   c. 3
   d. 1
   e. 7
   f. 2
   g. 4

5. b, d, f

6. a. 1
   b. 2

7. b, c, e, f

8. Answer should include any two of the following

   a. Enable more food to be produced on same area
   b. Control plant diseases, parasites, insects, and weeds
   c. Control animal diseases, parasites and insects
   d. Preserve outdoor activities

9. Answer should include any two of the following

   a. Cause nature imbalance
   b. Pollute streams and water supply
   c. Pollute crops
   d. Pollute soil
   e. Injure desirable plants
   f. Persistent residues in food chain

ANSWERS TO TEST

10. a, b, c, d, e, f, g, h

11. a. 3 b. 2 c. 1

12. a. 3
    b. 5
    c. 4
    d. 2
    e. 7
    f. 6
    g. 1

13. a. 3 b. 4 c. 2 d. 5 e. 1

14. Evaluated to satisfaction of instructor

15. a. 3
    b. 2
    c. 7
    d. 5
    e. 1
    f. 6
    g. 4

16. a. 3 b. 2 c. 4 d. 1 e. 5

17. Answer should include any four of the following

    a. Follow all safety precautions stated on label
    b. Use protective clothing and equipment
    c. Rinse empty containers and measuring cups
    d. Only mix compatible pesticides
    e. Avoid splashes, spills, and leaks
    f. Wash all contaminated areas on clothing or equipment
    g. Dispose of empty containers properly

18. 2.5 lbs per 75 gallons of water

19. 30 pints or 15 quarts or 3 gallons and 3 quarts

20. a. 2
    b. 4
    c. 6
    d. 3
    e. 7
    f. 9
    g. 1
    h. 5
    i. 8

21. a. Tank
    b. Shutoff
    c. Line strainer
    d. Pump
    e. Boom or nozzle
    f. Pressure gauge
    g. Agitator

22. a. Solid cone
    b. Hollow cone
    c. Flooding flat
    d. Regular flat

23. Answer should include any two of the following

    a. Soil moisture
    b. Rain
    c. Humidity
    d. Temperature
    e. Light

ANSWERS TO TEST

24. Evaluated to satisfaction of instructor

25. a. Careless practices b. Ignorance

26. a. Oral b. Dermal c. Inhalation

27. a. Dermal and inhalation
    b. Oral and dermal

28. a. Check to see if patient is breathing
    b. Call doctor or take victim to doctor or hospital
    c. Locate pesticide label and have available for doctor

29. Evaluated to satisfaction of instructor

30. a, b, c, d, e, f

31. a, b, c, d, e, f

32. Answer should include any four of the following

    a. Open burning
    b. Burial
    c. Recycling
    d. Pesticide-approved incinerator
    e. Chemical degradation
    f. Soil injection
    g. Encapsulation

33. Evaluated to satisfaction of instructor

SEED SELECTION
UNIT 14

UNIT OBJECTIVE

After completing this unit, the student should be able to select good quality seed, list factors to consider in selecting high quality seed, and conditions that exist when good seed is not selected. The student should also be able to list the certifiable seed classes, list information required on certified seed tags, and calculate pure live seed. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with seed selection to the correct definitions.
2. List four factors to look consider in selecting high quality seed.
3. Select from a list conditions that exist when good seed is not selected.
4. List two means of securing good seed.
5. Arrange in order the four certifiable seed classes.
6. Select from a list information required on certified seed tags.
7. Name three types of seed treatment.
8. Select from a list procedures to follow in handling and storing seed.
9. Calculate the value of pure live seed.

SEED SELECTION
UNIT 14

SUGGESTED ACTIVITIES

- I. Suggested activities
    - A. Order materials to supplement unit
        - 1. Literature
            - A. Vegetable Grower's Seed Guide, Asgrow Seed Company, Kalamazoo, Michigan 49001
            - B. Idaho Bean Commission, 415 S. 13th, P.O. Box 9433, Boise, Idaho 83707
            - C. Idaho Rules of Certification, Idaho Crop Improvement Association, Inc., 1641 S. Curtis Road, Boise, Idaho 83705
        - 2. Filmstrips, slideshows, etc.
        - 3. Films
    - B. Make transparencies
    - C. Provide students with objective sheet
    - D. Provide students with information and assignment sheets
    - E. Discuss unit and specific objectives
    - F. Discuss information and assignment sheets
    - G. Give test
    - H. Reteach if necessary
    - I. Retest
- II. Instructional materials
    - A. Objective sheet
    - B. Suggested activities
    - C. Information sheet

SUGGESTED ACTIVITIES

D. Transparency masters

  1. TM 1--Seed label requirements

E. Assignment sheets

  1. AS 1--Determining seed value

  2. AS 2--Comparing seed lots

F. Answers to assignment sheets

G. Job sheets

  1. JS 1--The warm germination test

  2. JS 2--The cold test

  3. JS 3--The TZ test

I. Test

I. Answers to test

III. Unit references

A. Delorit, R.J., et al. Crop Production, 4th edition, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

B. Fridline, C.R. Seed Production of Corn, Small Grains, and Soybeans. Columbus, OH. Ohio Agricultural Education Curriculum Materials Service: 1977.

C. Vegetable Grower's Seed Guide. Asgrow Seed Co. Kalamazoo, MI: 1982.

D. Idaho Rules of Certification. Idaho Crop Improvement Association, Inc. Boise, ID: 1983.

E. Seed Selection. Oklahoma State Board for Vocational Technical Education. Stillwater, OK: Ag II, Unit IV.

F. Planting. College Station, Texas. Teaching Materials Center. Agriculture Education Department. Texas A & M University: Vo-ag I, Unit IV-F.

G. Murray, G. "Plant Science 407: Crop Production", class notes, Spring 1983, University of Idaho, Mosocw, ID.

SEED SELECTION
UNIT 14

INFORMATION SHEET

I. Terms and definitions

A. Seed--Plant embryo and stored food surrounded by a seed coat

B. Breeder seed--Seed or vegetatively propagated material that is controlled by the originator; initial source of seed for that variety

C. Foundation seed--Second link in the certified seed chain; produced from breeder seed and handled in such a way as to ensure genetic identity and varietal purity

D. Registered seed--Third link in the certified seed chain; seed produced from foundation seed or recertified registered seed; used to produce certified seed

E. Certified seed--Seed which is guaranteed by a state agency to meet certain minimum requirements in respect to purity, germination, and other characteristics; may be progeny of foundation, registered, or reregistered certified seed

F. Common seed--No minimum requirements in respect to purity, germination percentage, and other characteristics; not inspected by state agency

G. Inert matter--Percentage by weight of chaff, broken seeds, stems, and soil particles

H. Hard seed--Seed which remains hard at the end of the prescribed test because it has not absorbed water due to an impermeable seed coat

I. Pure live seed--Amount of seed when planted that has potential to produce plants

II. Factors to consider in selecting high quality seed

A. Purity

(Note: Good seed should be free from noxious weeds, inert matter, dirt, chaff, and seeds of other crops or other varieties.)

B. Viability

(Note: Viability determined by germination percentage and vigor index, if present. Generally, 85% germination is considered minimum. Check date on seed. If it is more than one year old, it should be retested for germination percentage. Refer to Idaho Rules of Certification for exact requirements of certified seed.)

INFORMATION SHEET

C. Free of disease

(Note: The great loss in using diseased seed is not in the cost of the seed, but in the cost of control measures or loss in crop produced from the disease.)

D. Free of insects

E. Size and plumpness

(Note: large, plump, and well developed seed contain more plant food to give the young plant a good start.)

III. Conditions that exist when good seed is not selected

A. Low germination percentage

B. Large amount of inert matter

C. Has large amount of other crop seed

D. Infested with weed seed

E. Lacks resistance to or harbors disease

F. Lacks resistance to or is infested by insects

G. Lacks adaptability to certain climatic and growing conditions

H. Fails to remain viable from harvest to planting time

IV. Means of securing good seed

A. Home grown

B. Reliable seed dealers

V. Certifiable seed classes

(Note: Potatoes are not classified using this system.)

A. Breeder seed

(Note: Breeder seed has the strictest requirements of classes for pest control, isolation, genetic purity, and handling to prevent contamination of seed lot.)

B. Foundation seed

(Note: Foundation seed is first to get into the hands of grower; distribution usually only to select growers in an area; progeny of breeder seed.)

INFORMATION SHEET

C. Registered seed

(Note: Progeny of either foundation or recertified registered seed; requirements of this class not as strict as breeder and foundation.)

D. Certified seed

(Note: Progeny of either foundation, registered, or reregistered certified seed; this class has the lowest requirements of certifiable classes, but still quite strict.)

VI. Information required on certified seed tag (Transparency #1)

A. Common name of seed represented

Example: UI 114 - Bean

B. Percent by weight of purity

C. Percent by weight of weed seeds

D. Number of seeds per pound of noxious weeds

E. Percent germination

F. Date

VII. Types of seed treatment

A. Chemical

(Note: Most chemical seed treatments are general fungicides to control seed or soil-borne fungal seedling diseases.)

B. Pelletizing

(Note: Pelletizing seed is done mainly to make the seed size more uniform for ease of planting. Pelletizing also enhances germination, and chemicals may be added during process to aid in pest control. Some seed treatments are harmful to the inoculant.)

C. Inoculation

(Note: Legumes are able to fix atmospheric nitrogen through a symbiotic relationship with rhizobium bacteria. Inoculation is coating of the seed with this bacteria to ensure its presence in the soil.)

INFORMATION SHEET

VIII. Procedure to follow in handling and storing seed

A. Purchase foundation, registered, or certified seed for planting

B. Select clean seed

C. Control weeds

D. Prevent seed from mixing

E. Store in a cool, dry place

F. Treat seed for insects and disease

G. Protect from rodents

H. Test seed for germination

I. Inspect seed during storage

J. Make sure seed moisture is favorable for storage before harvesting home grown seed

IX. Determining the value of pure live seed

a. Using the prices and labels from two different lots of Common Bermuda grass seed, the better seed can be selected by the number of pounds of pure live seed that are in each lot and the cost per pound of each lot

1. Label information

Lot 1	Lot 2
Germination----85.00%	Germination----80.00 %
Inert Matter----1.33%	Inert Matter----2.45%
Weed Seed--------.02%	Weed Seed--------.02%
Other Crop Seed-2.78%	Other Crop Seed-3.78%

2. Determine purity content

Lot 1	Lot 2
Inert Matter----1.33%	Inert Matter----2.45%
Weed Seed--------.02%	Weed Seed--------.02%
Other Crop Seed-2.78%	Other Crop Seed-3.78%
Non-purities----4.13%	Non-purities----6.25%
100.00%	100.00%
- 4.13%	- 6.25%
95.87% pure seed	93.75% pure seed

3. Cost--Lot 1 is \$65.00 cwt. and Lot 2 is \$62.00 cwt.

4. Determine value of different lots

Formula-- $\frac{\text{Price per unit}}{\text{purity\% X germination\%}}$ = Price paid per hundred pounds of pure live seed

Lot 1

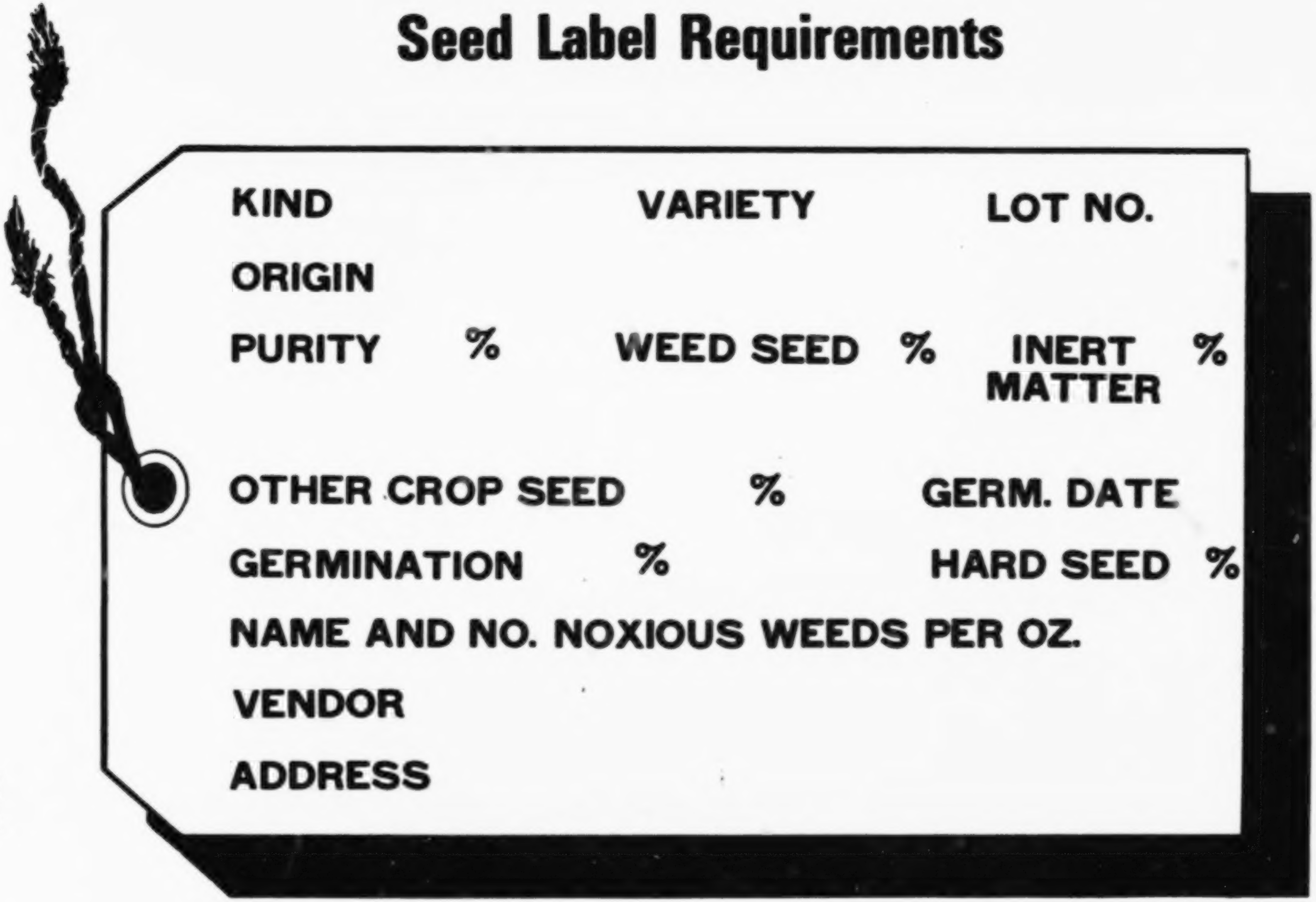
$\frac{\$65.00}{.9587 \text{ X } .85}$ = \$80.24 per hundred pounds

Lot 2

$\frac{\$62.00}{.9375 \text{ X } .80}$ = \$84.00 per hundred pounds

(Note: The seed cost of lot 2 is more expensive for pure seed, even though the price per hundred weight is slightly lower than lot 1. Before buying seed, the seed label should be studied. It is the "key" to the best seed buy.)

Seed Label Requirements



KIND VARIETY LOT NO.

ORIGIN

PURITY % WEED SEED % INERT MATTER %

OTHER CROP SEED % GERM. DATE

GERMINATION % HARD SEED %

NAME AND NO. NOXIOUS WEEDS PER OZ.

VENDOR

ADDRESS

TM #1

CSS 14 9

SEED SELECTION
UNIT 14

ASSIGNMENT SHEET #1--DETERMINING SEED VALUE

Pure live seed is used as a method of determining seed values by comparing purtiy and germination in relation to price. In determining seed values use the following formula:

$$\frac{\text{Price per unit}}{\text{Purity x Germination}} = \text{Price per unit of pure live seed}$$

Lot A		Lot B	
Germination	80.0%	Germination	94.0%
Inert matter	4.5%	Inert matter	3.0%
Other crop seeds	.3%	Other crop seeds	.3%
Weed seeds	.2%	Weed seeds	.2%
Price per bu. of 60 lbs	$5.00	Price per bu. of 60 lbs	$5.50

Using the preceding information, answer the following questions.

1. How many pounds of pure seed in:
   a. Lot A
   b. Lot B
2. How many pounds of pure live seed in:
   a. Lot A
   b. Lot B
3. What is the difference between pure seed and pure live seed?
4. How much per bushel will pure live seed cost in:
   a. Lot A
   b. Lot B

SEED SELECTION
UNIT 14

ASSIGNMENT SHEET #2--COMPARING SEED LOTS

Pure live seed is used as a method of determining seed values by comparing purity and germination in relation to price. In determining seed values use the following formula:

$$\frac{\text{Price per unit}}{\text{Purity x Germination}} = \text{Price per unit of pure live seed}$$

Obtain at least two seed labels from different lots of the same crop (wheat, beans, etc.). Fill in the needed information from the seed label.

Kind of Seed and I.D. No.	Cost/Bu. or Lb.	Germination %	Weed Seeds %	Inert Matter %	Other Seeds %	Purity %	Price/Unit Pure Live Seed

SEED SELECTION
UNIT 14

ANSWERS TO ASSIGNMENT SHEETS

Assignment sheet #1

1. a. 57 pounds
   b. 57.9 pounds
2. a. 45.6 pounds
   b. 54.4 pounds
3. Pure live seed considers germination percentage and purity, while pure seed considers only purity.
4. a. $6.58 bushel
   b. $6.04 bushel

Assignment sheet #2--Evaluated to satisfaction of instructor

SEED SELECTION
UNIT 14

JOB SHEET #1--THE WARM GERMINATION TEST

I. Equipment

A. Adequate supply of corn, bean, wheat, and oat seeds
B. A roll of paper towels or strips of absorbent cloth 12 inches wide and 12 to 16 inches in length. The length of cloth strips can be determined by the number of seeds to be tested.
C. A bucket, tub, or other suitable container to hold the paper or cloth rolls containing the seeds.

II. Procedure

A. Select a predetermined number of seeds to be tested (10, 20, 50, or 100)

B. Place the seeds between moistened layers of paper towels or cloths. Seeds should be spaced 1 inch apart for easier counting later

C. Roll up the moistened towels or cloths and place in a suitable container. Keep rolls moist throughout the test period and the temperature at 60-70° F.

D. Mark each roll with an identifying number or letter.

E. Check each roll for germination after three days. Count and record the number of seeds that show root or stem sprouts or both. Repeat the above procedure after five days.

F. At the end of seven days, count all seeds showing strong stem and root sprouts.

G. Calculate the germination percentage by dividing the number of germinated seeds by the total number used in the test (and multiplying by 100).

SEED SELECTION
UNIT 14

JOB SHEET #2--THE COLD TEST

I. Equipment

A. About one gallon of soil-sand mixture (75% soil, 25% sand) is needed for each test to be made.

B. A roll of heavy-duty paper towels (made specifically for germination tests) or strips of absorbent cloth 12 inches wide and 2 to 4 feet long.

C. Adequate supply of corn and bean seeds. If a comparison between warm germination and cold tests is to be made, the seeds for both tests should come from the same lot.

D. A refrigerator where the temperature can be kept at 50° F.

II. Procedure

A. Select the seeds to be tested

B. Place the seeds on the paper towels or cloth strips about one inch apart. Sprinkle the moistened soil-sand mixture over the seeds, barely covering them. Cover the seed and soil mixture with another paper towel and roll up. Place in a suitable container and keep rolls moist throughout the test period.

C. For one week, place the seed and soil-sand mixture in a refrigerator set at 50° F.

D. Remove from the refrigerator to a warmer area of 65-70° F for one week to permit germination.

E. Count the germinated seeds and claculate germination percentage.

F. Observe results and make conclusions.

SEED SELECTION
UNIT 14

JOB SHEET #3--THE TZ TEST

I. Equipment

- A. Adequate supply of corn and bean seed. For comparison purposes, seeds from the same lots used in the warm and cold germination tests should be used.
- B. Small supply of 2,3,5-triphenyl tetrazolium chloride. This can be obtained from the Seed or Crop Improvement Association of your state.

II. Procedure

- A. Soak seeds in warm water at a temperature of 85-100 F for about two hours. (A longer period will do no harm.) This soaking will soften the seeds and activate the enzymes inside them.
- B. Cut the seeds to be tested lengthwise through the center to expose the full length of the germ. Seeds are easily cut with a sharp single-edged safety razor blade.
- C. Place halves of the sectioned seeds in a 1.0% solution of TZ. Then warm the solution to 85-100 F or leave at room temperature (75 F). Leave the seed halves in the solution two hours at 85-100 F or four hours at 75 F.
- D. Remove seed halves from the solution and examine with a magnifying lens for color changes. All actively respiring parts of the germ become red or deep pink. The endosperm and all dead parts of the germ do not change color. When the entire germ of the seed turns red, the seed is alive and capable of germinating.

SEED SELECTION
UNIT 14

TEST

NAME______________________________ SCORE______________

1. Match terms associated with seed selection to the correct definitions. Write the correct numbers in the blanks.

   1. Seed
   2. Breeder seed
   3. Foundation seed
   4. Registered seed
   5. Certified seed
   6. Common seed
   7. Inert matter
   8. Hard seed
   9. Pure live seed

_____a. Seed which is guaranteed by a state agency to meet certain minimum requirements in respect to purity, and other characteristics

_____b. Plant embryo and stored food surrounded by a seed coat

_____c. Second link in the certified seed chain, produced from breeder seed and handled in such a way as to ensure genetic identity and varietal purity

_____d. Percentage by weight of chaff, broken seeds, stems, and soil particles

_____e. Amount of seed when planted that has potential to produce plants

_____f. No minimum requirements in respect to purity, germination percentage, and other characteristics; not inspected by a state agency

_____g. Third link in certified seed chain

_____h. Seed which remains hard at the end of the prescribed test because it has not absorbed water due to an impermeable seed coat

_____i. Seed or vegetatively propagated material that is controlled by the originator; initial source of seed for that variety

2. List four factors to consider in selecting high quality seed.

a.____

b.____

c.____

d.____

TEST

3. Select from the following list conditions that exist when good seed is not selected. Write an "X" in the blank before each correct answer.

_____a. Lacks resistance or is infested by insects

_____b. Has small amount of inert matter

_____c. Lacks viability

_____d. Infested with weed seed

_____e. Has large amount of other crop seed

_____f. Is adapted to local growing conditions

_____g. Resistant to local disease

_____h. Low germination percentage

4. Name two means of securing good seed.

a. ____

b. ____

5. Arrange in order the certifiable seed classes. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Foundation seed

_____b. Registered seed

_____c. Certified seed

_____d. Breeder seed

6. Select from the following list information required on certified seed tags. Write an "X" in the blank before each correct answer.

_____a. Date

_____b. Common name of seed

_____c. Vigor index

_____d. Latin binomial name of seed

_____e. Percent by weight of weed seeds

_____f. Germination percentage

_____g. Number of noxious weeds

_____h. Number of common weed seeds

TEST

7. Name three types of seed treatment.

a.____

b.____

c.____

8. Select from the following list procedures to follow in handling and storing seed. Write an "X" in the blank before each correct answer.

_____a. Make sure seed moisture content for storage is correct prior to harvesting

_____b. Inspect seed during storage

_____c. Test seed for germination

_____d. Protect from rodents

_____e. Treat seed for insects and disease

_____f. Store in a cool, dry place

_____g. Prevent mixing of seed

_____h. Control weeds

_____i. Select clean seed

_____j. Purchase certified seed for planting

9. Using the following information, calculate the cost per bushel of pure live seed for both seed lots. Show all work.

Lot A		Lot B	
Germination	95.0%	Germination	80.0%
Inert matter	4.5%	Inert matter	3.0%
Other crop seeds	3%	Other crop seeds	.3%
Weed seeds	.2%	Weed seeds	.2%
Price per bu. of 60 lbs	$6.00	Price per bu. of 60 lbs	$5.50

SEED SELECTION
UNIT 14

ANSWERS TO TEST

1. a. 5 d. 7 g. 4
   b. 1 e. 9 h. 8
   c. 3 f. 6 i. 2

2. Answer should include any four of the following

   a. Purity d. Free of insects
   b. Viability e. Size and plumpness
   c. Free of disease

3. a, c, d, e, h

4. a. Home grown b. Reliable seed dealers

5. a. 2 b. 3 c. 4 d. 1

6. a, b, e, f, g

7. a. Chemical b. Pelletizing c. Inoculation

8. a, b, c, d, e, f, g, h, i, j

9. Lot A = $6.67 per bushel of pure live seed
   Lot B = $7.12 per bushel of pure live seed

PLANTING
UNIT 15

UNIT OBJECTIVES

After completing this unit, the student should be able to list the five functions of planters and grain drills, name the parts of a row-crop planter and grain drill, and select from a list factors to consider in planting to maximize yields. This knowledge will be shown by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with planting to the correct definitions.
2. List three environmental conditions necessary for germination.
3. Name the two plant growth zones.
4. List five functions of planters and grain drills.
5. Identify types of planters.
6. Match types of row-crop planting to the correct situation.
7. Identify the parts of a row-crop planter.
8. Name two types of grain drills.
9. Identify the parts of a grain drill.
10. Select from a list factors to consider in planting to maximize yields.
11. Match common crops with the correct per bushel weight.
12. Match common crops with the correct average planting depth.
13. Match common crops to the correct method of seeding.

PLANTING
UNIT 15

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. Planting, an FMO publication by John Deere, 5 chapters on seeds and planting equipment; order from John Deere Service Publications, Dept. F, John Deere Road, Moline, IL, 62165.

      b. Planting and Seeding Equipment, class activity packet available from Agri-Farm Publications, Inc., 1019 Market St., Gowrie, IA, 50543; approx. cost $14.40; order no. 1118.

      c. Planting & Seeding Equipment, instructional packet, available from IAVIM, 208 Davidson Hall, Iowa State Univ., Ames, IA, 50011; approx. cost $3.00, order no. 207.

    2. Filmstrips, slideshows, etc.

      a. Planting, slide set available from John Deere Service Publications, Dept. F, John Deere Road, Moline, IL, 62165; approx. cost $90.00.

    3. Films

  B. Make transparencies

  C. Provide students with objective sheet

  D. Provide students with information sheet

  E. Discuss unit and specific objectives

  F. Discuss information sheet

  G. Invite local machinery dealer to address class on advances in modern planting equipment

SUGGESTED ACTIVITIES

- H. Calibrate a grain drill during class
- I. Give test
- J. Reteach if necessary
- K. Retest

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Transparency masters
    1. TM 1--Environmental conditions necessary for germination
    2. TM 2--Plant growth zones
    3. TM 3--Why is seedbed so important?
    4. TM 4--Functions of planters
    5. TM 5--Depth of planting seed
    6. TM 6--The size of seed determines planting depth
    7. TM 7--Row-crop planters
    8. TM 8--Drilling grain
    9. TM 9--Broadcast seeders
    10. TM 10--Specialized planters
    11. TM 11--Types of row-crop planter
    12. TM 12--Parts of a row-crop planter
    13. TM 13--Parts of a press-wheel grain drill
- E. Test
- F. Answers to test

SUGGESTED ACTIVITIES

III. Unit references

A. Delorit, R.J., et al. Crop Production, 4th edition, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

B. Janick, J., et al, Plant Science, 2nd edition. San Francisco, CA. W.H. Freeman and Company: 1974.

C. Hudson, H.T., et al, Plant Science - Growth, Development, and Utilization of Cultivated Plants. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.: 1981

D. Aldrich, S.R., et al. Modern Corn Production, 2nd edition. A & L Publications. Champaign, Illinois: 1982.

E. Breece, H.E. Planting. John Deere Service Publication. Moline, Illinois: 1975.

F. Planting. College Station, Texas. Teaching Materials Center. Agriculture Education Department. Texas A & M University: Vo-ag I, Unit IV-F.

G. Murray, G. "Plant Science 407: Crop Production", class notes, Spring 1983, University of Idaho, Mosocw, ID.

H. Vegetable Grower's Seed Guide. Asgrow Co. Kalamazoo, MI: 1982.

PLANTING
UNIT 15

INFORMATION SHEET

I. Terms and definitions

   A. Broadcast--A method of sowing seeds by randomly scattering them on the ground

   B. Drill planting--Seeds are dropped on an individual basis at a pre-determined spacing between seeds in the row

   C. Seedbed--Area directly beneath the planting unit prepared for the seed

   D. Rootbed--Area to either side and below seed to rooting depth of crop; more loosely prepared allowing for air and moisture to move into the soil to support root growth

   E. Furrow--Narrow groove made in the soil by the furrow openers into which the seeds are dropped

   F. Furrow opener--A single or double disc device that opens a furrow in the soil for the seed

   G. Germination--The point at which a seed having adequate moisture, temperature, and oxygen begins to grow

   H. Emergence--The point in plant growth when the plant actually breaks through the soil surface

II. Environmental conditions necessary for germination (Transparency #1)

   A. Moisture

   B. Oxygen

   C. Heat

III. Plant growth zones (Transparency #2)

   A. Seedbed (Transparency #3)

   (Note: The furrow opener makes a furrow at the selected depth. The seed is dropped into the furrow and then covered. The seedbed area over and to each side of the seed is usually firmed and packed by a press wheel. This should provide a firm but not too compact seedbed. This firm seedbed will better provide moisture for germination than a loose, open one. However, the soil must not be packed so tightly that the supply of oxygen to the seed or seedling is restricted.)

INFORMATION SHEET

B. Rootbed

(Note: The rootbed should be loose and less compacted than the seedbed. The loose soil allows the roots to grow and develop working their way through the soil, increasing the area from which it will collect moisture and nutrients. The more open rootbed area will allow for better moisture and oxygen movement down into the root zone providing moisture and oxygen for the young seedling.)

IV. Functions of planters and grain drills (Transparency #4)

A. Open a furrow in the soil

(Note: The furrow opener must maintain the seed furrow at the proper depth in a variety of soil conditions. If the seed is planted too shallow or too deep, it may not germinate because the environmental conditions may be poor. Shallow planting is okay if adequate moisture is available to the seed. Planting too deep causes problems with emergence and not germination.)

B. Meter the seed

(Note: A controlled seeding rate, such as seeds per acre, bushels per acre or pounds per acre is desired when planting most crops to obtain the optimum yield. Metering of seed is considered one of the major functions of any seeding or planting machine.)

C. Place the seed (Transparencies #5 and #6)

(Note: Depth and space between seeds greatly affects the yield of a crop. When seeds are properly placed in a well-prepared seedbed, a high percentage will germinate; and more plants can be expected to emerge under normal conditions.)

D. Cover the seed

(Note: If seed is broadcast seeded and it is necessary to cover it, it will be necessary to use other implements.)

E. Firm the seedbed

(Note: A firm seedbed provides excellent soil and moisture contact with the seed and thus improves conditions for germination.)

INFORMATION SHEET

V. Types of planters

A. Row-crop planters (Transparency #7)

B. Grain drills (Transparency #8)

C. Broadcast seeders (Transparency #9)

D. Specialized planters (Transparency #10)

VI. Types of row-crop planting (Transparency #11)

A. Flat-land planting--Used in areas where rainfall is sufficient to grow a crop from planting to harvest without irrigation; also used for crops requiring flat surface for harvest, e.g. peas

B. Bed planting--Used in areas where there is too much moisture prior to planting or where it is desirable to apply irrigation water in furrows between beds

C. Furrow planting--Used in areas where there is a limited amount of rainfall during the growing season

VII. Parts of a row-crop planter (Transparency #12)

A. Frame

B. Drive wheel

C. Seed hopper

D. Furrow openers

E. Seed metering device

F. Seeding depth adjustment

G. Seed covering device

H. Press wheel

I. Materials attachments

(Note: Modern cultural practices include application of fertilizer, herbicide, or insecticide individually or in any combination at the time of planting.)

INFORMATION SHEET

VIII. Types of grain drills

   A. End-wheel drill--Have wheels that support and drive the drill

   B. Press-wheel--Have press-wheel gangs mounted on the rear of the drill; press wheels firm the soil over the seed, drive the metering mechanism, and support the rear of the drill

IX. Parts of a press-wheel grain drill (Transparency #13)

   A. Frame

   B. Grass seed hopper

   C. Seed hopper

   D. Fertilizer hopper

   E. Furrow openers

   F. Seed metering device

   G. Seeding depth adjustment

   H. Seed press wheel

   I. Materials attachments

   (Note: Attachments such as a grass seed hopper, fertilizer hopper, etc. may be added to the plain drill if desired.)

X. Factors to consider in planting to maximize yield

   A. Time of planting

   (Note: The best time of planting varies with the crop and the geographic location. Some factors to consider when determining time of planting include: soil temperature for germination, prominence of disease; heat during seed set, frost before maturity, etc. Consult with county extension agent or other local expert to determine the proper time to plant your crop under your existing conditions.)

INFORMATION SHEET

B. Seeding depth

(Note: Soil condition is one of the major factors in determining the depth to plant. The factors that determine depth to plant are: (1) soil texture--seed can be planted deeper in sandy soil than clay soil; (2) soil temperature--seed can be planted deeper in warm soil than cold soil; (3) soil moisture--seed is planted deeper in dry soil than wet soil; (4) Plant structure--some seeds can be planted deeper because of their emergence structure and food reserve. Large seed will emerge from a greater depth than small seed.)

C. Seeding rate

(Note: The seeding rate is as variable between different crops as it is between climates and soils conditions. Some of the major factors affecting optimum seeding rates are: available moisture, soil fertility, germination, row spacing, planter operation, and end use, e.g. a higher seeding rate is used for alfalfa when raised as forage rather than seed. Seeding rates are lower for dryland farming areas and higher for irrigated farming areas for the same crops.)

D. Soil preparation

(Note: Obtaining best results and profits depends a lot on how the land is prepared for planting. The previous crop and the presence or absence of residue will influence necessary operations, soil temperature, moisture, and fertility.)

E. Soil fertility

(Note: The productivity of the soil plus the stored reserves of plant nutrients must be evaluated before the crop is planted. A soil test should be made far enough in advance of planting so that nutrient levels found to be too low to produce optimum yields can be corrected before the plants need the nutrients. Do not soil test too early as nutrients may be lost in areas of high winter precipitation.)

F. Tillage

(Note: The purpose of tillage is to prepare the soil so that seeds will germinate, to ensure optimum yields will be produced, for pest control, for moisture control, for fertilizer application, for residue management, etc.)

G. Weed and insect control

INFORMATION SHEET

XI. Seeds in a pound and pounds in a bushel for common crops

Table 1

Crop	Number of seeds/lb.	Number of lbs./bushel
Alfalfa	220,000	60
Barley	13,000	48
Beans	1,600	--
Corn	1,500	56
Ken. Bluegrass	2,156,000	--
Oats	13,000	37
Peas	2,120	--
Red Clover	272,000	--
Rye	18,000	56
Sorghum	15,000	50
Soybeans	3,000	60
Wheat	12,000	60

XII. Depth to plant and germination period

Table 2

Crop	Average planting depth-inches	Days required for germination
Alfalfa	1/4 to 3/4	4 - 7
Barley	1 to 2	3 - 7
Beans	1 1/2	6 - 7
Corn	1 to 3	4 - 7
Ken. Bluegrass	1/4 to 1/2	
Oats	1 to 2	5 - 10
Peas	2 to 3	8
Red Clover	1/4 to 3/4	
Wheat	1 to 2	3 - 7
Potatoes	3 to 5	

INFORMATION SHEET

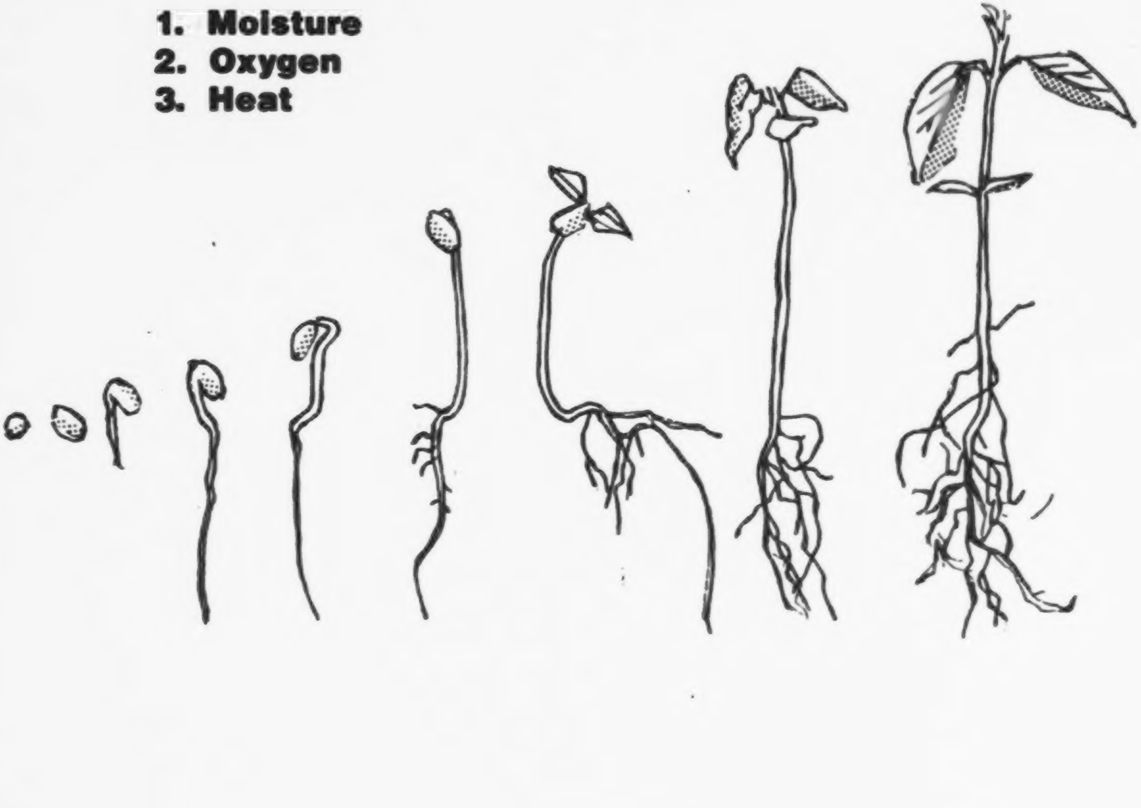
XIII. Rates, space, and methods of seeding crops

Table 3

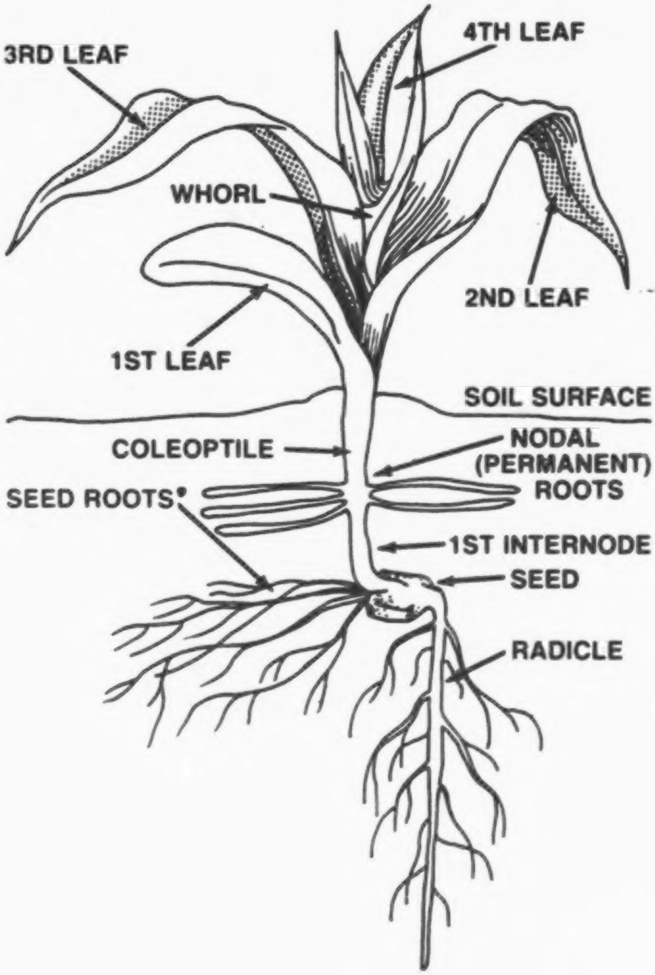
Crop	Rate of Planting Per Acre	Seeding Space	Method of Seeding
Alfalfa	6-12 lbs.	15-30 seeds/ft.	drill-grass seeder
Barley	80-130 lbs.	8-10 seeds/ft.	drill
Beans	70 lbs.	5 seeds/ft.	rows - 22" to 24"
Corn	20,000 plants	8 inches	rows - 30" to 36"
Ken. Bluegrass	4 lbs.	100 seeds/ft.	drill or broadcast
Lentils	50-60 lbs.	4-5 seeds/ft.	drill
Oats	80-100 lbs.	8-10 seeds/ft.	drill or broadcast
Peas	125-175 lbs.	6-8 seeds/ft.	drill
Potatoes	250-300 lbs.	2 seeds/ft.	rows - "34" to 36"
Red Clover	4 lbs.	13 seeds/ft.	drill-grass seeder
Wheat	60-150 lbs.	8-10 seeds/ft.	drill

Environmental Conditions Necessary for Germination

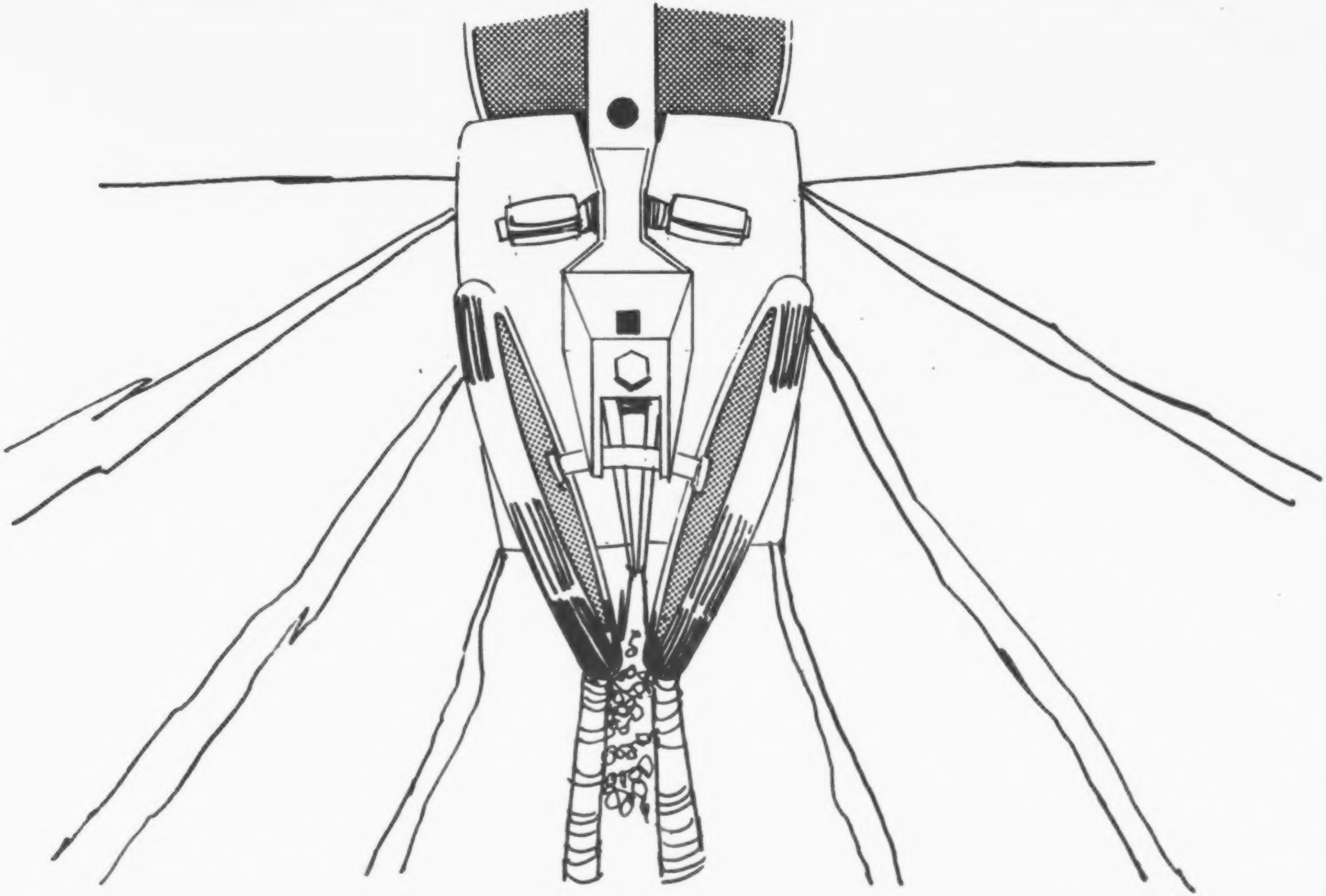
1. **Moisture**
2. **Oxygen**
3. **Heat**



PLANT GROWTH ZONES


3RD LEAF
4TH LEAF
WHORL
2ND LEAF
1ST LEAF
SOIL SURFACE
COLEOPTILE
NODAL (PERMANENT) ROOTS
SEED ROOTS*
1ST INTERNODE
SEED
RADICLE

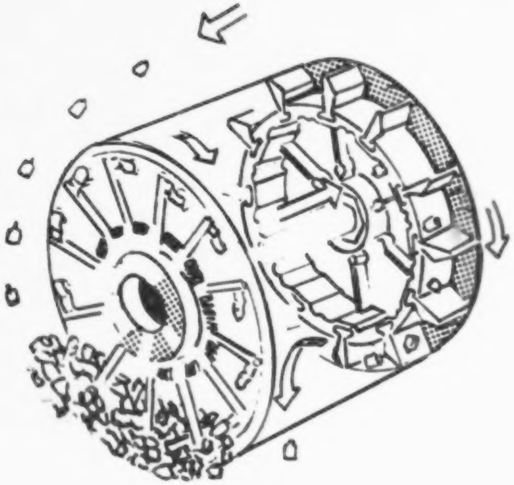
WHY IS THE SEEDBED SO IMPORTANT?

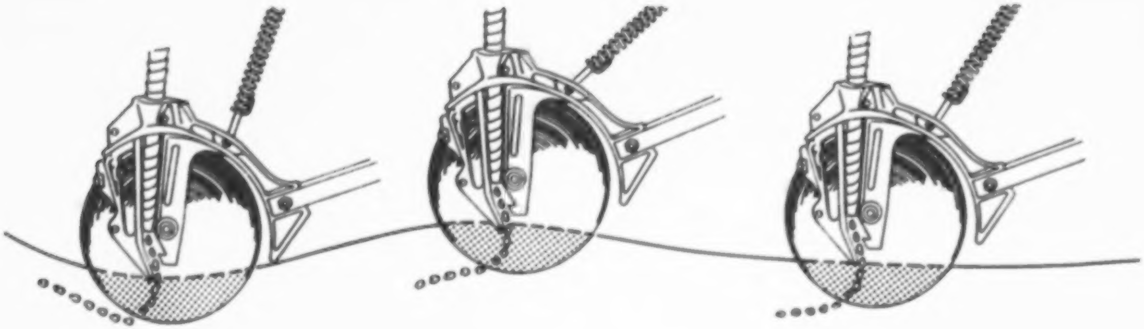


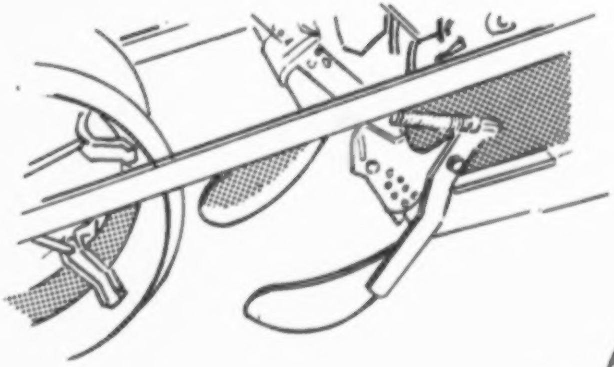
TM #3

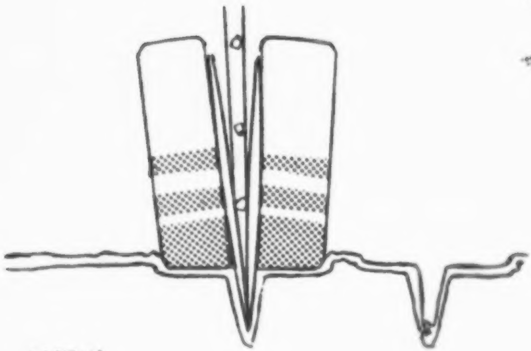
CSS 15 14

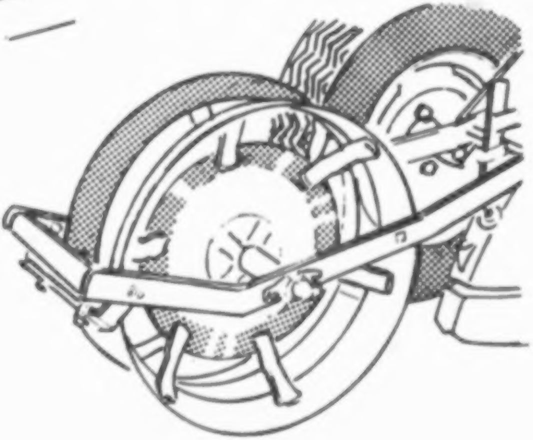
FUNCTIONS OF PLANTERS







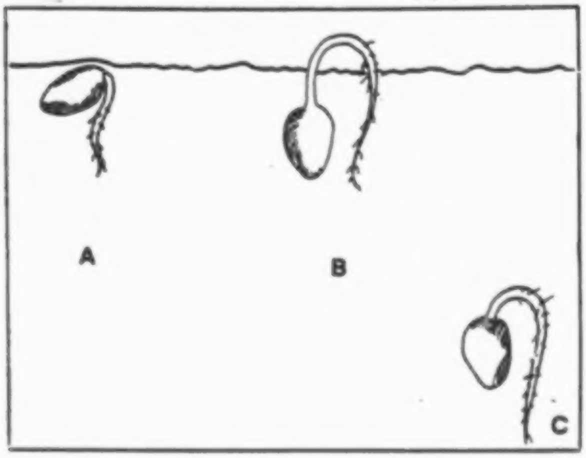




TM #4

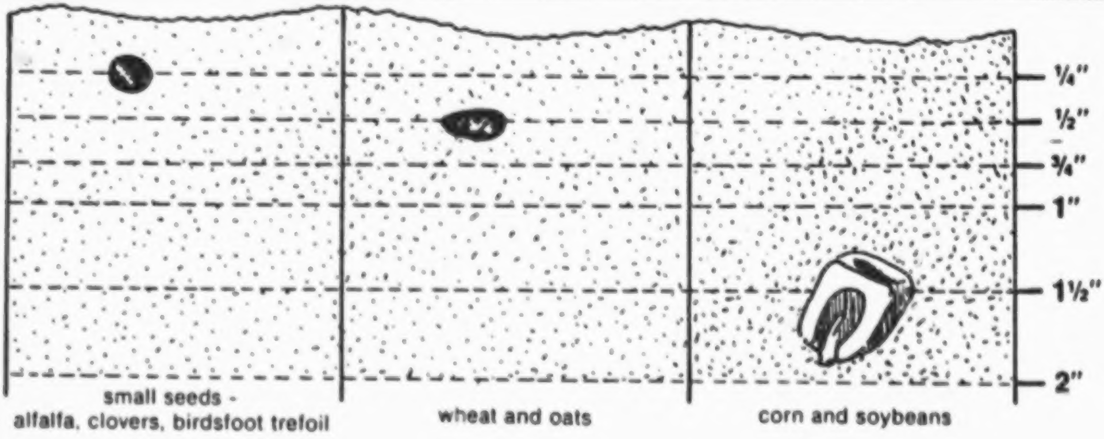
CSS 15 15

Depth of Planting Seed



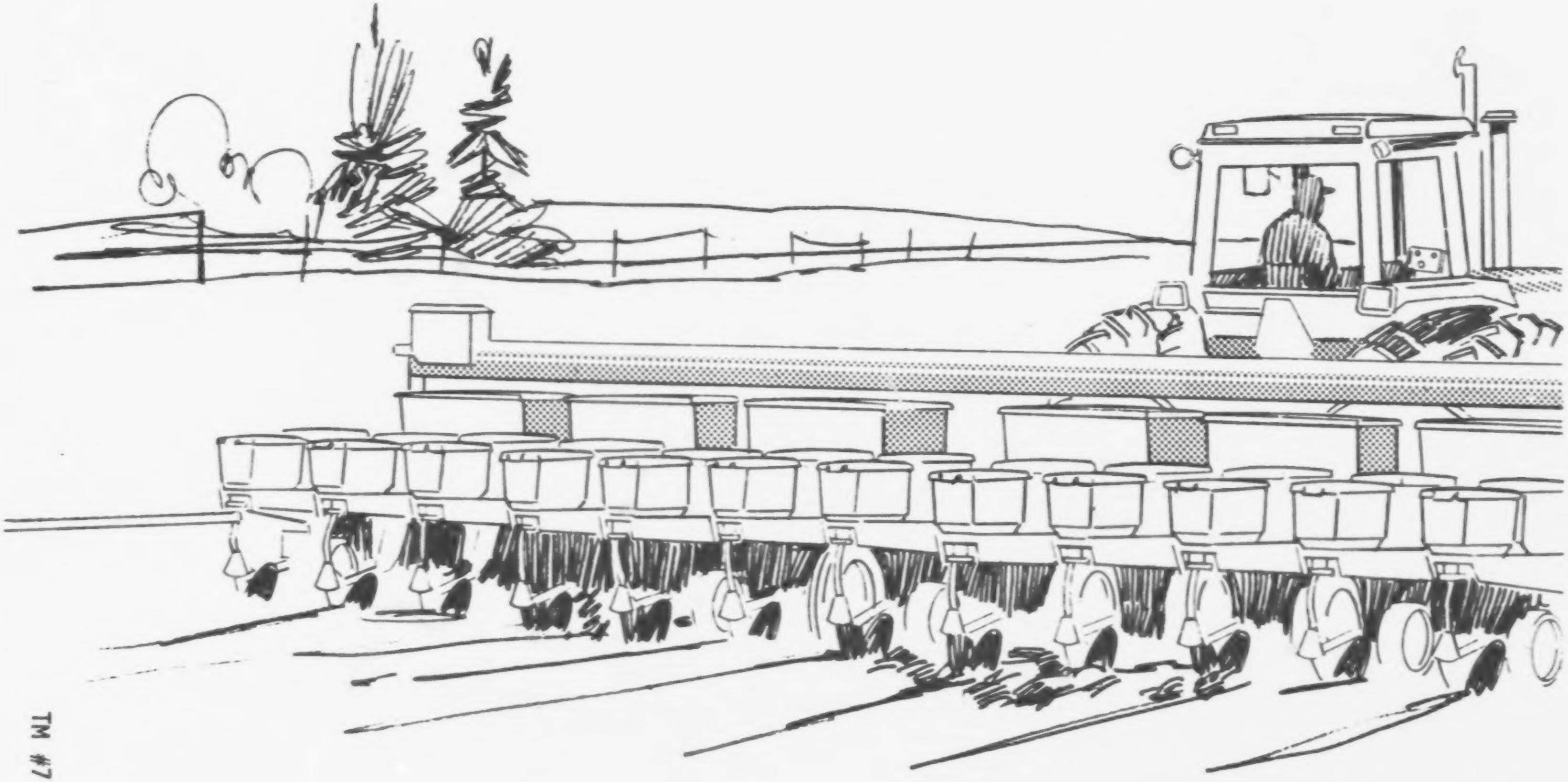
A. **Too shallow-seed may die for lack of moisture**
B. **Correct depth**
C. **Too deep hypocotyl does not elongate enough to reach soil surface; seed uses up stored food and rots**

The Size of Seed Determines Planting Depth


¼"
½"
¾"
1"
1½"
2"
small seeds -
alfalfa, clovers, birdsfoot trefoil
wheat and oats
corn and soybeans

500

ROW-CROP PLANTERS

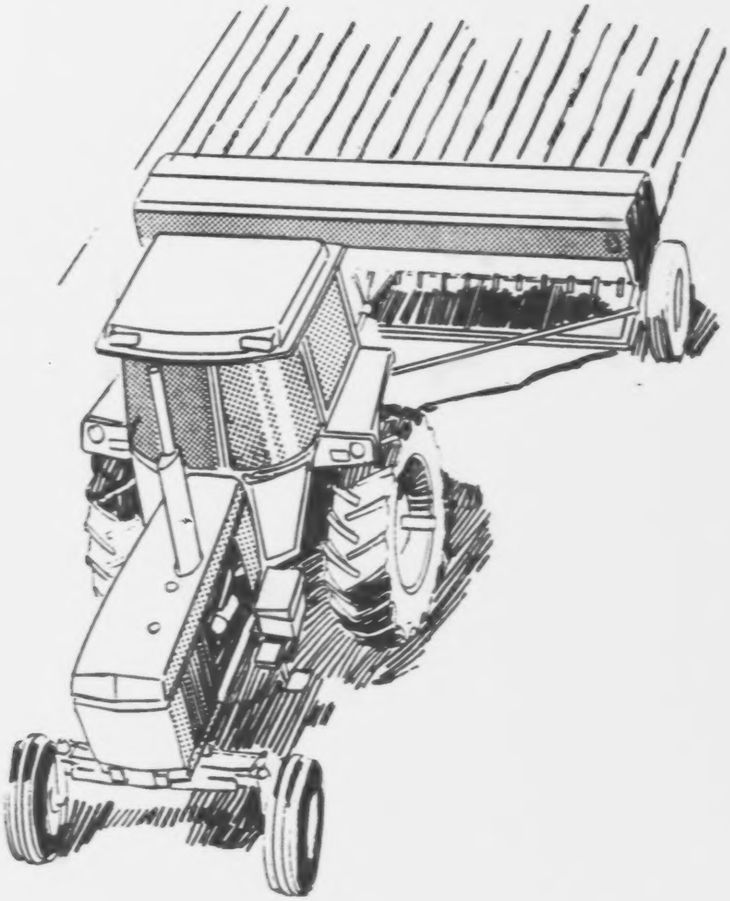


TM #7

CSS 15 18

CSS 15 19

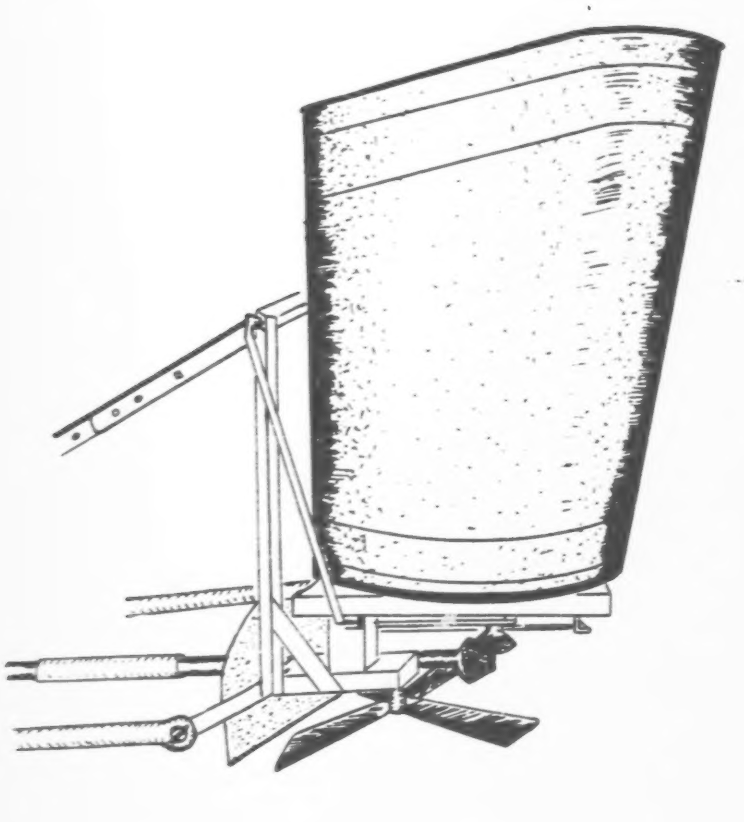
DRILLING GRAIN



TM #8

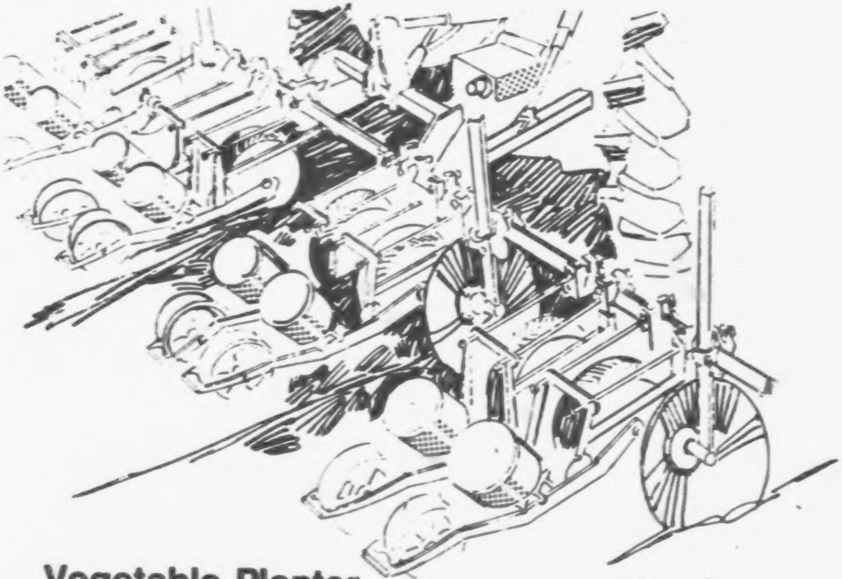
CSS 15 20

Broadcast Seeder



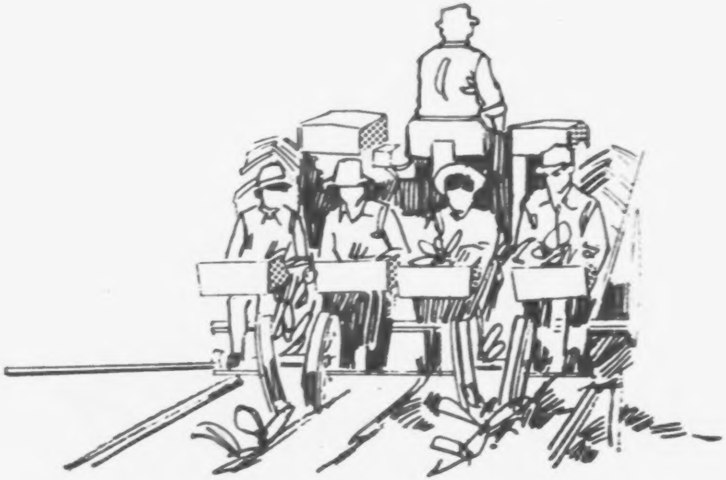
TM #9

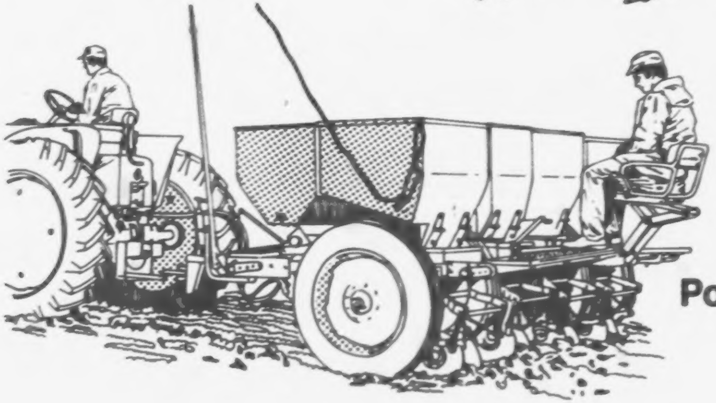
SPECIALIZED PLANTERS



Vegetable Planter

Transplanter





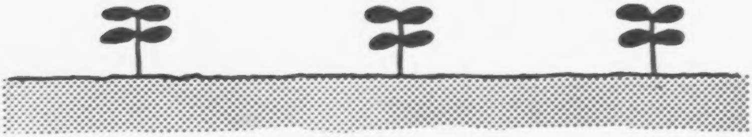
Potato Planter

TM #10

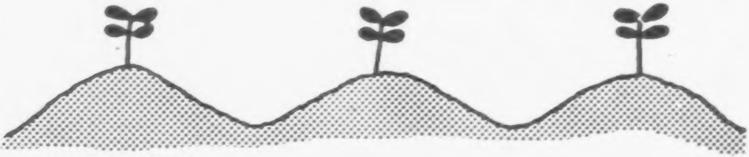
CSS 15 21

Types of Row-Crop Planting

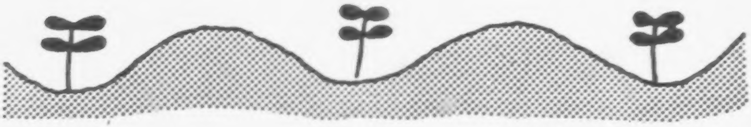
1. **Flat Land Planting**



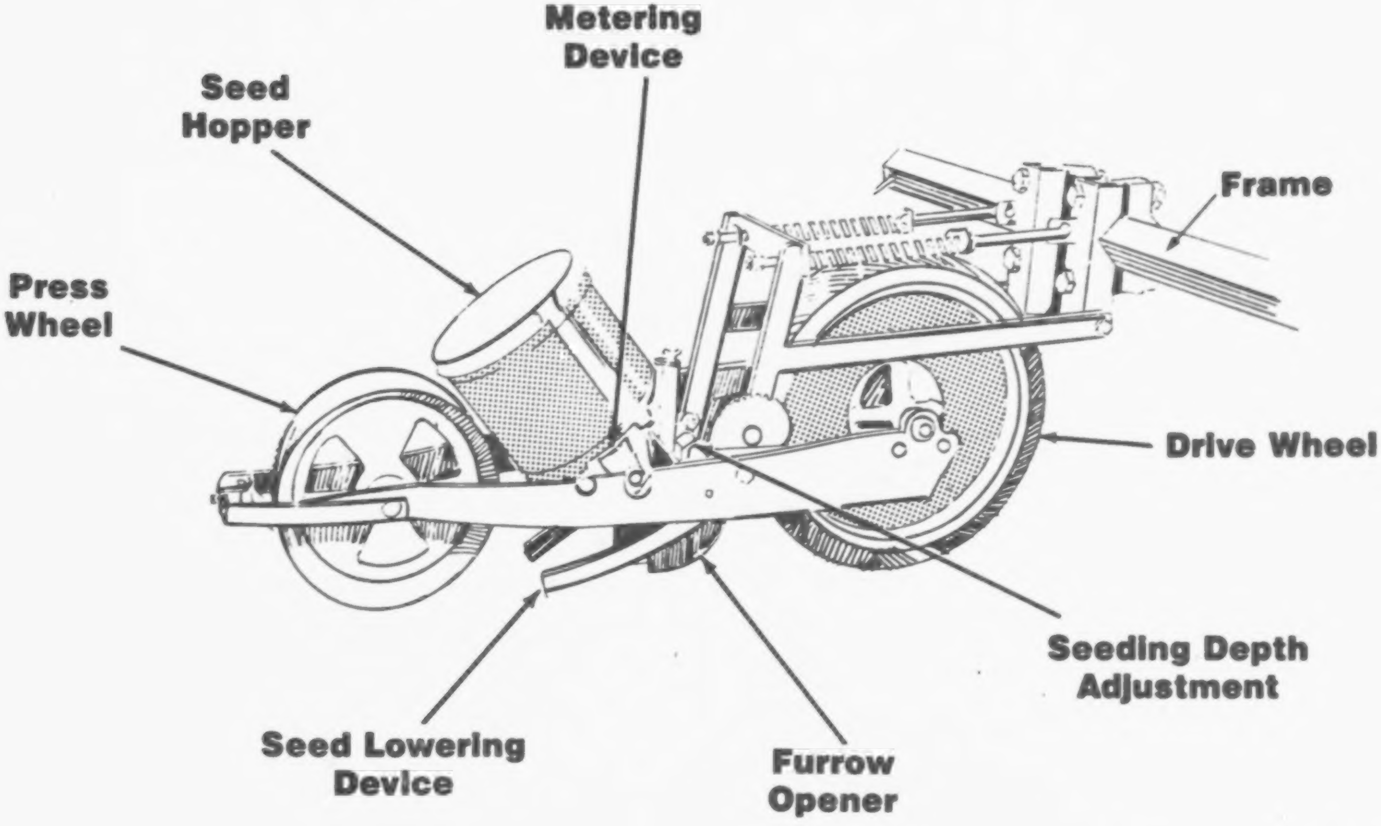
2. **Bed Planting**



3. **Furrow Planting**



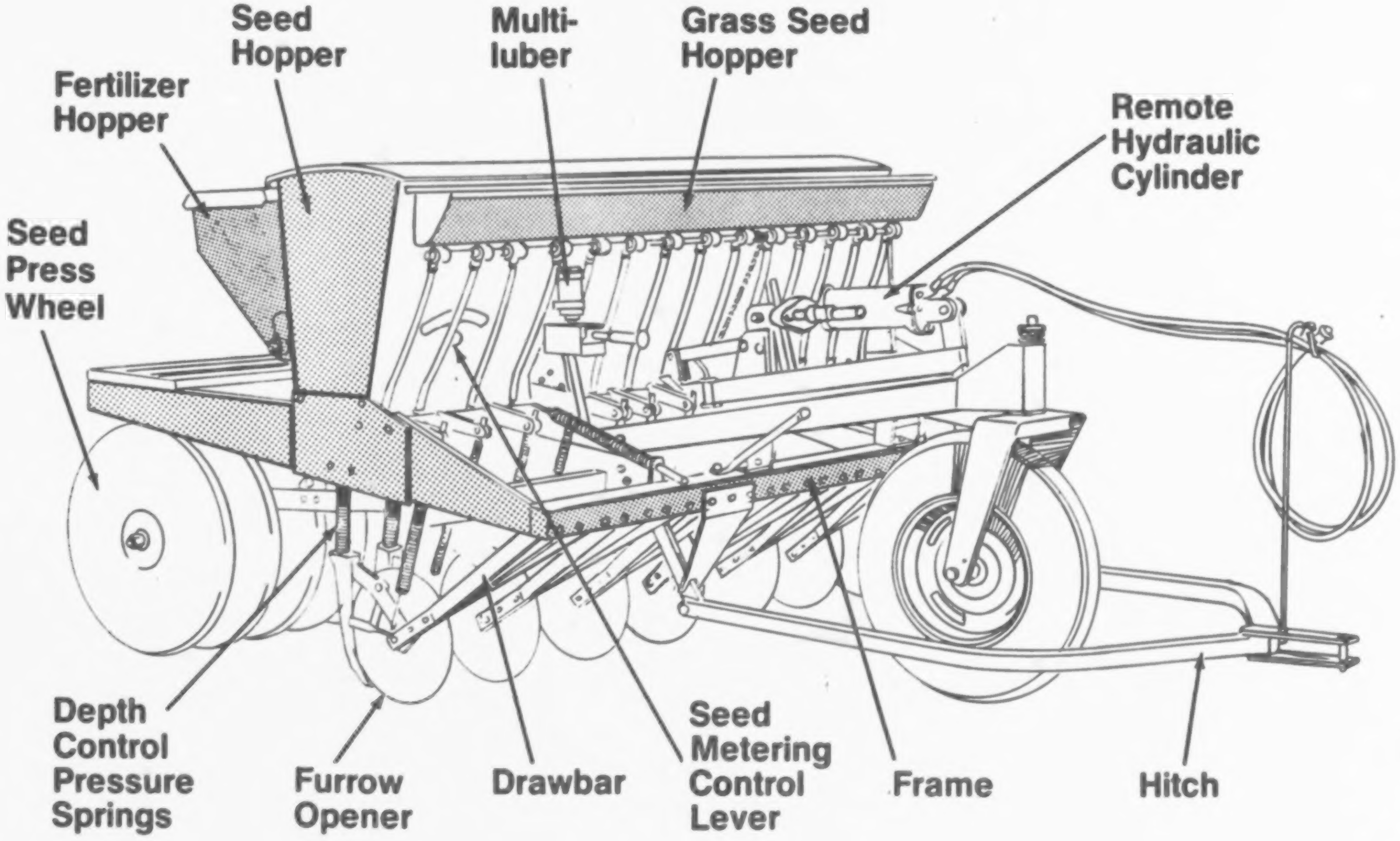
Parts of a Row-Crop Planter


Metering Device
Seed Hopper
Frame
Press Wheel
Drive Wheel
Seeding Depth Adjustment
Seed Lowering Device
Furrow Opener

TM #12

CSS 15 23

Parts of a Press-Wheel Grain Drill


Seed Hopper
Multi-luber
Grass Seed Hopper
Fertilizer Hopper
Remote Hydraulic Cylinder
Seed Press Wheel
Depth Control Pressure Springs
Furrow Opener
Drawbar
Seed Metering Control Lever
Frame
Hitch

TM #13

CSS 15 24

PLANTING
UNIT 15

TEST

NAME______________________________ SCORE__________

1. Match terms associated with planting to the correct definitions. Write the correct numbers in the blanks.

1. Broadcast
2. Drill planting
3. Seedbed
4. Rootbed
5. Furrow
6. Furrow Opener
7. Germination
8. Emergence

_____a. The point in plant growth when the plant actually breaks through the soil surface

_____b. Area to either side and below seed to rooting depth of crop

_____c. Narrow groove made in the soil by the furrow openers into which the seeds are dropped

_____d. A method of sowing seeds by randomly scattering them on the ground

_____e. Area directly beneath the planting unit prepared for the seed

_____f. The point at which a seed having adequate moisture, temperature, and oxygen begins to grow

_____g. A single or double disc device that opens a narrow groove in the soil for the seed.

_____h. Seeds are dropped on an individual basis at a predetermined spacing between seeds in the row

2. List three environmental conditions necessary for germination.

a.____

b.____

c.____

3. Name the two plant growth zones.

a.____

b.____________________ ____________________

TEST

4. List five functions of planters and grain drills.

a. ______________________________

b. ______________________________

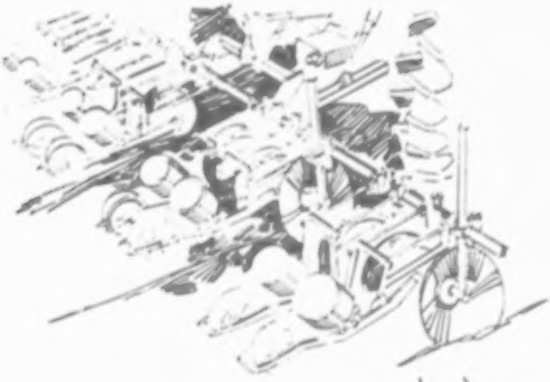
c. ______________________________

d. ______________________________

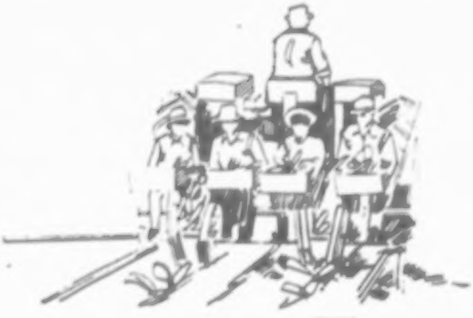
e. ______________________________

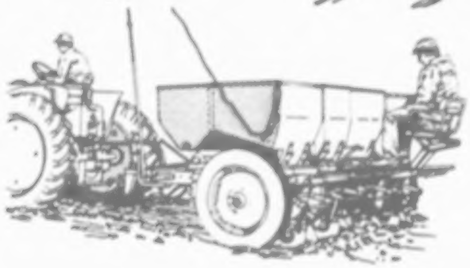
5. Identify the types of planters. Write the correct names in the blanks.

a. ____________________



b. ____________________





c. ____________________

TEST

6. Match types of row-crop planting to the correct situation. Write the correct numbers in the blanks.

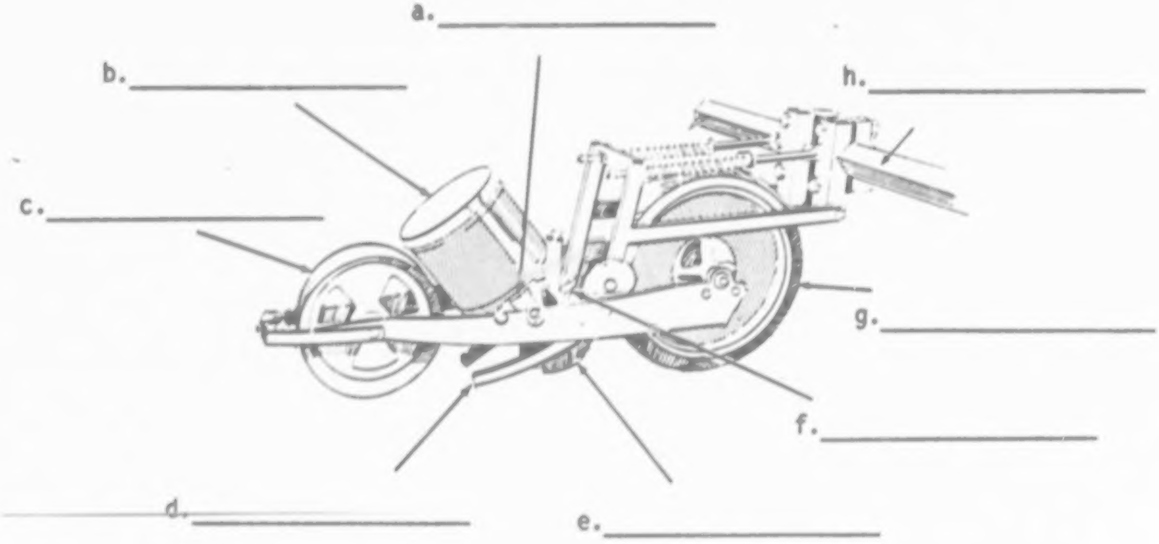
1. Flat land planting
2. Bed planting
3. Furrow planting

_____a. Used in areas where there is too much moisture prior to planting or where it is desirable to apply irrigation water in furrows between beds

_____b. Used in areas where rainfall is sufficient to grow a crop from planting to harvest without irrigation

_____c. Used in areas where there is a limited amount of rainfall during the growing season

7. Identify the parts of a row-crop planter. Write the correct names in the blanks.



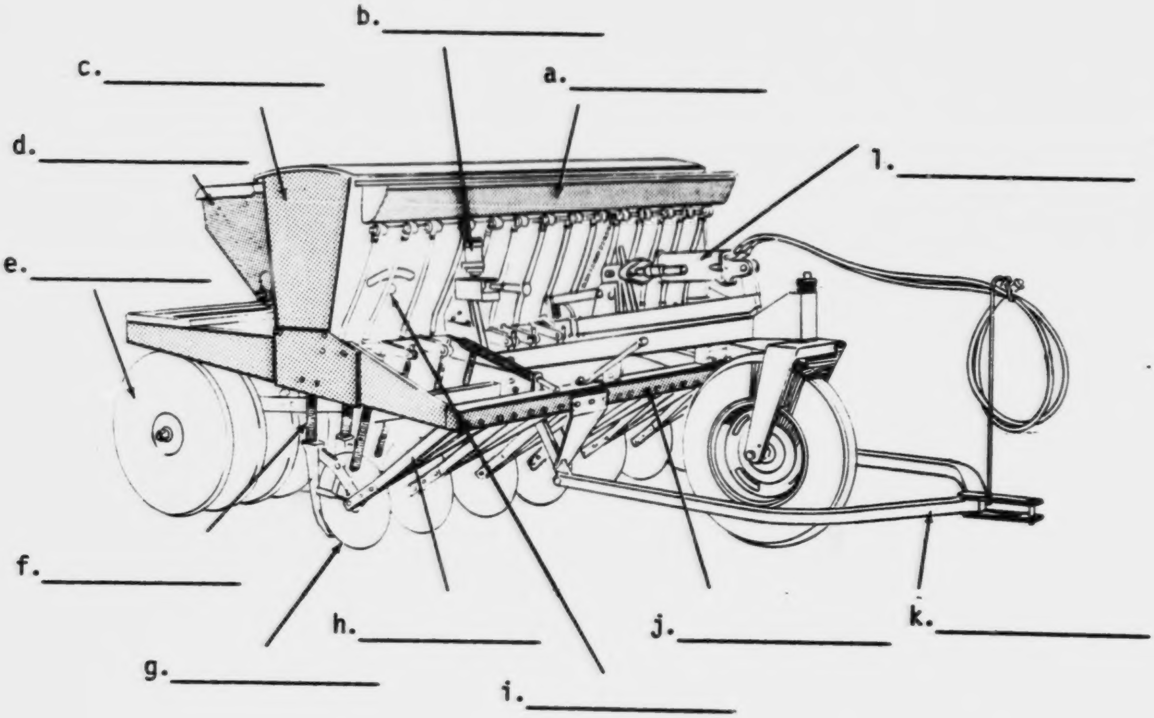
8. Name two types of grain drills.

a. ____

b. ____

TEST

9. Identify the parts of a grain drill. Write the correct names in the blanks.



10. Select from the following list factors to consider in planting to maximize yields. Write an "X" in the blank before each correct answer.

_____a. Weed control

_____b. Insect control

_____c. Tillage

_____d. Soil fertility

_____e. Soil preparation

_____f. Seeding rate

_____g. Seeding depth

_____h. Time of planting

TEST

11. Match common crops with the correct per bushel weight. Write the correct numbers in the blanks.

1.	37 pounds	4.	56 pounds
2.	48 pounds	5.	60 pounds
3.	50 pounds		

_____a. Alfalfa

_____b. Barley

_____c. Corn

_____d. Oats

_____e. Rye

_____f. Sorghum

_____g. Soybeans

_____h. Wheat

12. Match common crops with the correct average planting depth. Write the correct numbers in the blanks.

1.	1/4 to 3/4 inch	4.	1 to 3 inches
2.	1 to 2 inches	5.	2 to 3 inches
3.	1 1/2 inches	6.	3 to 5 inches

_____a. Potatoes

_____b. Wheat

_____c. Alfalfa

_____d. Barley

_____e. Red clover

_____f. Peas

_____g. Beans

_____h. Corn

_____i. Oats

TEST

13. Match common crops to the correct method of seeding. Write the correct numbers in the blanks.

1. Row planter
2. Drill
3. Drill with grass seeder
4. Drill or broadcast

_____a. Red clover

_____b. Peas

_____c. Barley

_____d. Beans

_____e. Potatoes

_____f. Wheat

_____g. Corn

_____h. Kentucky bluegrass

_____i. Alfalfa

PLANTING
UNIT 15

ANSWERS TO TEST

1. a. 8
   b. 4
   c. 5
   d. 1
   e. 3
   f. 7
   g. 6
   h. 2

2. a. Moisture
   b. Oxygen
   c. Heat

3. a. Seedbed
   b. Roofbed

4. a. Open a furrow in the soil
   b. Meter the seed
   c. Place the seed
   d. Cover the seed
   e. Firm the seedbed

5. a. Row-crop planter
   b. Grain drill
   c. Broadcast seeder
   d. Specialized planter

6. a. 2
   b. 1
   c. 3.

7. a. Frame
   b. Drive wheel
   c. Seed hopper
   d. Furrow openers
   e. Seed metering device
   f. Seeding depth adjustment
   g. Seed covering device
   h. Press wheel

8. a. End-wheel drill
   b. Press-wheel drill

9. a. Frame
   b. Grass seed hopper
   c. Seed hopper
   d. Fertilizer hopper
   e. Furrow openers
   f. Press wheel

10. a, b, c, d, e, f, g, h

11. a. 5
    b. 2
    c. 4
    d. 1
    e. 4
    f. 3
    g. 5
    h. 5

12. a. 6
    b. 2
    c. 1
    d. 2
    e. 1
    f. 5
    g. 3
    h. 4
    i. 2

ANSWERS TO TEST

13.	a.	3	f.	2
	b.	2	g.	1
	c.	2	h.	4
	d.	1	i.	3
	e.	1		

POTATO PRODUCTION
UNIT 16

UNIT OBJECTIVE

After completing this unit, the student should be able to describe potato production techniques involved in seedbed preparation, fertilizer requirements, seed preparation, planting, cultivation, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with potato production to the correct definitions.
2. Select from a list leading potato producing states.
3. Discuss the economic importance of potato production to Idaho.
4. Identify the parts of a potato plant.
5. Identify the parts of a potato tuber.
6. Select from a list characterisitics of a desirable seedbed.
7. List three tillage operations involved in seedbed preparation.
8. Name three common varieties of seed.
9. Discuss the major points in selecting and preparing seed.
10. Name two types of planters.
11. Select from a list factors to consider in planting potatoes.
12. Select from a list factors that influence final plant populations.
13. Calculate fertilizer requirements for potatoes.
14. Name two potato diseases.
15. Name two harmful insects of potatoes.
16. Discuss how weeds compete with potatoes.

OBJECTIVE SHEET

17. List three ways weeds cause losses in potato production.
18. Match the general categories of weeds to the correct description.
19. Name three methods of weed control.
20. Select from a list herbicides used to control weeds in potatoes.
21. List two types of cultivation.
22. Select from a list reasons for killing vines prior to harvest.
23. Name two ways to kill potato vines.
24. Select from a list methods of handling potatoes to reduce bruising.
25. Tell what a proper potato storage environment consists of and how it is provided.
26. List the four uses of potatoes.
27. Name three grades of potatoes for fresh pack.
28. Discuss the sizing of potatoes for fresh pack.

POTATO PRODUCTION
UNIT 16

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. Potato Handbook, 3-ring binder containing all University of Idaho CIS publications related to potatoes; order from Ag Information, University of Idaho, Moscow, ID, 83843; approximate cost $9.00 plus $1.00 for postage and packaging.

      b. Cooperative Extension Publications, order catalog from: Bulleting department, Cooperative Extension, Cooperative Publications Bldg., Washington State University, Pullman, WA, 99164.

      c. Estimated Costs and Returns For a 100 acre Seed Potato Enterprise, Idaho Farm Business Management Series #10; order from Ag Information , University of Idaho, Moscow, ID 83843.

    2. Filmstrips, slideshows, etc.

    3. Films

  B. Make transparencies

  C. Provide students with objective sheet

  D. Provide students with information and assignment sheets

  E. Discuss unit and specific objectives

  F. Discuss information and assignment sheets

  G. Field trip to potato processing and fresh pack company

SUGGESTED ACTIVITIES

H. Arrange for potato inspector to be a guest speaker on grading and sizing potatoes

I. Give test

J. Reteach if necessary

K. Retest

II. Instructional materials

A. Objectives

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Principle potato producing areas

2. TM 2--Leading potato producing states

3. TM 3--Parts of a potato plant

4. TM 4--Cross section of a potato tuber

E. Assignment sheets

1. AS 1--Make fertilizer recommendation for potatoes

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Delorit, R.J., et al, Crop Production, 4th edition. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

B. Potato Handbook. University of Idaho. Moscow, ID: 1983

C. Comercial Potato Production in North America. Potato Association of American Handbook. Orono, Maine. Potato Association of America.

POTATO PRODUCTION
UNIT 16

INFORMATION SHEET

I. Terms and definitions

  A. Rhizomes--A subterranean (underground) stem

  B. Tubers--Enlarged tips of rhizome

  C. Suberization--The healing over of the cut part of the seed

  D. Feathered--Skin rubbed off at harvest

  E. Eyes--Bud areas on tuber that give rise to new stems and roots

II. Leading potato producing states (Transparency #1)

  A. Idaho

  B. Washington

  C. Maine

  D. Oregon

  E. North Dakota

  F. California

III. Economic importance of potato producation to Idaho

  A. 332,000 acres harvested

  B. 252 cwt. yield per harvested acre

  C. 83,590,000 cwt. total production

  D. Economic value to the state of $320,985,000

IV. Parts of a potato plant (Transparency #2)

  A. Flower

  B. Leaflets

  C. Stipules

  D. Stem

  E. Roots

  F. Tuber

INFORMATION SHEET

V. Parts of a potato tuber (Transparency #3)
  A. Corky epidermis
  B. Cortex
  C. Vascular ring
  D. Inner medulla
  E. Outer medulla
  F. Eyes or buds

VI. Characteristics of a desirable seedbed
  A. Loose and mellow
  B. Fairly level
  C. Free of large clods

     (Note: Large clods may cause injury to potatoes at harvest.)
  D. Adequate available moisture
  E. Free of weeds

VII. Tillage operations involved in seedbed preparation
  A. Primary tillage
    1. Moldboard plow
      a. Time--Fall
      b. Depth--6 to 8 inches
      c. Moisture needed
    2. Ripper (chisel plow)
      a. Time--Fall
      b. Depth--12 to 14 inches
      c. Dry conditions needed

INFORMATION SHEET

B. Secondary tillage

1. Disk

a. Time--Spring or fall

b. Depth--3 to 4 inches or deeper

2. Chisel

a. Time--Spring, before planting

b. Depth--3 to 4 inches or deeper

3. Harrow

a. Time--Spring, following chisel

b. Depth--Surface to 1 inch

VIII. Common varieties

A. Russett Burbank

(Note: Russett Burbank accounts for 98% of the state's production. It is a multipurpose variety suitable for fresh market and processing.)

B. Butte

C. Norgold

D. Lemhi

E. Nooksack

IV. Major points in selecting and preparing seed

A. Use only certified seed

(Note: Certified seed is inspected and held to requirements of disease control. Good cultural practices cannot be used to overcome the effects of poor quality seed.)

B. Avoid seed that has been:

1. Chilled

2. Frosted

3. Heated

4. Sprouted

INFORMATION SHEET

C. Cutting seed

1. Warm to 50° to 55° before cutting

2. Cut seed into pieces from 1 3/4 oz. to 3 oz.

   (Note: Seed pieces should average 2 oz.)

3. Screen out slivers and rotted seed

   (Note: Slivers interfere with planting and produce a weak plant.)

D. Handling cut seed

1. Cut in a draft-free area

2. Wet down floors for high humidity

   (Note: Most storages have humidification systems which would eliminate this step. High humidity encourages rapid healing or suberization of the cut surfaces.)

3. Treat seed pieces to help heal and protect against disease

4. Plant immediately after cutting when possible

5. If stored, store at 50° to 55° with ventilation and humidity for two weeks

6. Protect from sun and wind

X. Types of planters

A. Picker-type--Arms attached to a revolving wheel with two prongs at the end of each arm. The prong picks up a seed piece and deposits it in the dropping tube, and it falls into a trench made by furrow opener; requires one person for operation

B. Cup-type--Commonly used by growers who use whole tubers for seed. Cups on a chain carry seed pieces to dropping tube; requires one person for operation

XI. Factors to consider in planting potatoes

A. Time of planting

   (Note: Planting dates range from March 1 to June 18. The later the planting date, the lower the yield and percentage of #1 potatoes. Planting dates are later in seed-producing areas.)

INFORMATION SHEET

B. Seeding depth--4 to 5 inches

C. Seeding rates--2000 to 2500 lbs./acre

(Note: Seeding rate depends on rowspacing, plants per foot, seed size and how the potatoes will be marketed, i.e. commercials or seed.)

D. Rowspacing--34 to 36 inches

XII. Factors that influence final plant yields

A. Planting rate

B. Planting depth

C. Germination percentage

D. Vigor of seedling

E. Availability of plant nutrients

F. Moisture availability

G. Competition from weeds

H. Damage from disease and insects

XIII. Fertilizer requirements

A. Soil testing

(Note: Use soil test results in conjunction with CIS #261 - Idaho Fertilizer Guide for Potatoes. Nutrients of concern for soil test include nitrogen, phosphorus, potassium, and zinc. Applications of other nutrients have not been shown to be responsive or economical and are not suggested.)

B. Tissue analysis

(Note: Laboratory analysis of potato petioles to determine level of nitrogen and phosphorus in the plant. This test will detect a shortage of nutrients before visual symptoms appear and before yield has been reduced. If required, additional nutrients may be added during growing season through irrigation system.)

INFORMATION SHEET

XIV. Potato diseases

A. Early blight of potato

1. Symptoms--Dark brown to black colored, target shaped lesions on leaves and stems, older leaved infected first

2. Causal agent--A fungal disease that survives the winter on dead potato refuse in the field; spread by air-borne spores

3. Methods of control--Fungicides

4. Available fungicides--Bravo, Difolatan, Dithane M-45, Duter, Manzate 200, Supertin, etc.

B. Early dying (verticillium wilt)

1. Symptoms--Slight downward growth of petioles and yellowing of lower leaves. Leaf yellowing proceeds up the stem, with upper leaves last to show symptoms. Leaf yellowing is followed by wilt, browning, necrosis, flagging and eventual death of the stem.

2. Causal agent--Soil-borne fungus that lives on a broad range of hosts; infects by direct penetration into the roots; also through wounds, i.e. nematodes

3. Methods of control

    a. Sanitation

    b. Use resistant varieties, e.g. Russett Burbank

    c. Chemical control--Fungicides

4. Available fungicides--Telone, Telone C, Temik

C. Potato Ring Rot

1. Symptoms--Infected plant may produce completely or partially decayed tubers; foliage will yellow and the stem will eventually wilt and die; a milky ooze in the underground stem can be used to diagnose

2. Causal agent--Bacteria; survives in tubers; spreads mainly by contaminated machinery, cutting knives, bins

INFORMATION SHEET

3. Methods of control
    a. Plant certified seed
    b. Sanitation--Disinfect storage facilities, equipment, and machinery. Destroy all old sacks and volunteer plants from infected lot
    c. Rotate crop--Out of potatoes if field had ring rot the previous year

D. Blackleg (soft rot disease complex)
    1. Symptoms--Sunken, dark, moist rot develops on tuber giving a dark mush appearance to the tuber's core; mush lesions found anywhere on the stem below as well as above the soil line
    2. Causal agent--Bacteria; survive in seed tubers; spread by tuber-to-tuber contact, seed cutting, plant to plant by insects, and contact with contaminated surfaces
    3. Methods of control
        a. Plant seed known to be free of blackleg in the previous growing season and storage period
        b. Sanitation--Carefully clean and disinfect handling and planting equipment between each seed lot
        c. Plant single drop seed
        D. Irrigate with well water

E. Common scab of potato
    1. Symptoms--Severely blemished tuber that reduce visual attractiveness and value
    2. Causal agent--Soil borne fungi occurs early in growing season following tuber initiation; occurs only during plant growth
    3. Methods of control
        a. High soil moisture suppresses common scab
        b. Chemical control--PCNB (terraclor) treatment
        c. Plant resistant varieties, e.g. Norgold and Targhee

INFORMATION SHEET

F. Rhizoctonia disease of potato

1. Symptoms--Lesions that are reddish-brown in appearance occur on underground stems and stolons; infection of underground stems restricts movement of carbohydrates downward

2. Causal agent--Soilborne fungus; survives from year to year on dead tissue in soil (saprophyte); also survives on seed surfaces

3. Methods of control

    a. Plant clean, disease-free seed

    b. Chemical control--PCNB (Terraclor) treatment

    c. Use good cultural practices

G. Translucent-End of Potatoes

1. Symptoms—Affected tubers are irregularly shaped with pointed stem ends; affected tissue low in starch content, has a glassy appearance and has become soft and spongy; tuber is high in sugars and low in solids

2. Causal agent—Stress placed on the growing crop some time during the season; can be caused by moisture deficiencies, high temperatures and excess fertilization (N)

3. Methods of control

    a. Maintain soil moisture above 65% available throughout the season

    b. Follow University of Idaho nitrogen fertilization guide for potatoes

    c. Use resistant variety, e.g. Butte

XV. Insects affecting potato production

A. Colorado potato beetle

1. Description--Hard bodied, yellowish-brown with 10 black stripes on its wing covers and black spots on its head; approximately 3/8 inch long

2. Damage--Both adults and larvae feed on potato stems and leaves; larval feeding is more damaging

INFORMATION SHEET

3. Methods of control
    a. Biological--Beetles are preyed upon in egg or larva stage by ladybird beetles, green lacewings, collops beetles and predatory shield bugs
    b. Chemical
        1) Soil treatment--Di-Syston, Temik, Thimet
        2) Foliage treatment--Endosulfan, Guthion, Imidan, Monitor, Parathion, and Sevin

B. Wireworms
    1. Description--Larvae stage of click beetle; larvae are hard bodied, slender, cylindrical, shiny, yellow-to-green "worms" with small legs
    2. Damage--Bore holes in tuber, which look as if it were made by stabbing tuber with a nail
    3. Methods of control
        a. Chemical control--Parathion, Diazinon, Dyfonate, Phorate, Dasanit, Mocap 10G

C. Green Peach Aphid
    1. Description--Wingless form - light green with yellow tint duirng summer to pink to red in the fall; winged forms - dark brown with yellowish abdomen
    2. Damage--Injures new growth; transmits potato leafroll virus which is reponsible for net necrosis of potato tubers in susceptible varieties
    3. Methods of control
        a. Thoroughly spray peach and apricot trees in the spring
        b. Chemical control--Application at planting with with Phorate, Di-Syston, or Temik. Also use foliar applications with Monitor, etc.

INFORMATION SHEET

XVI. Weed competition with potatoes

A. Competition for water

B. Competition for nutrients

C. Competition for light

(Note: Potatoes and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XVII. Losses caused by weeds

A. Decreased yield

(Note: Uncontrolled weeds reduce Idaho potato yields an average of 11 sacks per acre, and very weedy fields lose 35 sacks or more.)

B. Decreased crop quality

C. Cost of control activities

(Note: Uncontrolled weeds and cultivation for weed control are costing Idaho potato growers an average of $42.00 per acre or 13 million dollars a year. Better weed control practices can prevent or reduce these losses.)

XVIII. General categories of weeds

A. Annual--Complete life cycle within the period of one year

(Note: Wild oats, lambsquarter and redroot pigweed are examples.)

B. Perennial--Live for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

(Note: Perennial weeds reduce yields more than annual weeds. Canada thistle can reduce yield as much as 70%, field bindweed 16%, and russian knapweed 32%. Quackgrass will not only reduce yield but also cause quality reduction from tuber deformation. Growing potatoes in fields heavily infested with deep-rooted perennials is not recommended.)

C. Broadleaf--Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots

D. Grass--Plant with longer, narrower leaves with parallel veination; monocots

INFORMATION SHEET

XIX. Methods of weed control

- A. Cultural
- B. Mechanical
- C. Chemical

XX. Control weeds in potatoes with herbicides

(Note: Before you use herbicides, read and understand the directions on the container label. Use directions given especially for potatoes. Refer to 1984 University of Idaho Weed Control Handbook for further helpful hints.)

- A. Weed problem: Annual broadleaf and grass weeds
    1. Eptam (EPTC)
    2. Paraquat CL (Paraquat)
    3. Treflan (Trifluralin)
    4. Lexone or Sencor (Metribuzin)
    5. Premerge 3 (dinoseb)
- B. Weed problem: Quackgrass control before potato emergence
    1. Eptam (EPTC)
    2. Dalapon M (dalapon)
- C. Weed problem: Emerging annual grasses before potato emergence
    1. Dowpon M (dalapon)
    2. Paraquat CL (paraquat)
- D. Problem: Potato vine kill
    1. Premerge 3 (dinoseb)
    2. Vertac General (dinoseb)
    3. Des-i-cate (endothall)
    4. Diquat 2 (diquat)

INFORMATION SHEET

XXI. Types of cultivation

- A. Hilling
  - 1. Covers weeds
  - 2. Gives cover for tuber from sun
- B. Inter-row
  - 1. Control weeds
  - 2. Aeration of soil

(Note: Cultivation for weed control is a general practice which results in an average loss of 12 1/2 sacks or more per acre. Tests show that some growers lose 20% or more in yield, with quality loss because of cultivation.)

XXII. Reasons for killing potato vines prior to harvest

- A. Stops growth
- B. Hastens maturity
- C. Toughens skin
- D. Checks formation of hollow hearts
- E. Reduces disease in seed fields

(Note: Mechanical vine killing is important when nature fails to do so.)

XXIII. Ways to kill potato vines

- A. Chemical sprays
- B. Rollers
- C. Vine beaters
- D. Rotary mowers
- E. Flaming

INFORMATION SHEET

XXIV. Handling of potatoes to reduce bruising

(Note: Potatoes can be damaged considerably during any one of the operations involved in digging, picking, hauling, grading, and storing. Careless handling of potatoes results in lower market price and excessive losses during storage. Immature tubers require particular care because they are high in water and their skin is easily "feathered" or rubbed off.)

A. Use rubber coated chains

B. Drop distance held at a minimum (6 inches)

C. Speed of chains and speed of travel should coincide with harvester capacity

D. Do not step on or kick potatoes

E. Modify potato harvesting and handling equipment to reduce bruising

(Note: Refer to University of Idaho CIS #330 - Modification to Potato Harvesting and Handling Equipment That Can Reduce Bruising.)

XXV. Proper potato storage environment

A. What it should accomplish

1. Stimulate healing of bruises, cuts, and other injuries
2. Maintain appearance and external quality of the tubers
3. Maintain internal quality of the tubers (food value, processability, etc.)
4. Keep rot development to a minimum
5. Keep weight loss to a minimum
6. Retard the growth of sprouts
7. Maintain seed potatoes in a healthy, vigorous and productive condition

B. What it consists of

1. Proper temperature
2. Proper humidity
3. Proper ventilation

INFORMATION SHEET

C. How it is provided and controlled

   1. Proper ventilation and management

   2. Correct and adequate distribution of airflow

   3. Humidification system

D. How it is evaluated

   1. Weight loss

   2. Rot loss

   3. Quality change

   (Note: Refer to University of Idaho CIS #349, #299, #297, and #136 for further information and ideas on improving storage conditions for potatoes.)

XXVI. Uses of potatoes

A. Fresh pack--Sold as fresh produce

B. Processed--Instant potatoes, french fries, tater tots, potato chips and snacks

C. Certified seed

D. Animal feed

E. Alcohol production

XXVII. Grading of potatoes for fresh pack

(Note: Grading is done by a qualified inspector.)

A. No. 1--A smooth uniform potato

B. No. 2--A larger, rough potato that can be trimmed

C. Culls--Small; bruised or odd-shaped potato

INFORMATION SHEET

XXVIII. Sizing of potatoes for fresh pack

(Note: Sizing is usually done by mechanical means)

A. Bakers, larger 14 oz. No. 1

B. Utility, larger 10-14 oz. No. 2

C. 70 count, 12 oz. No. 1

D. 80 count, 10 oz. No. 1

E. 90 count, 9 oz. No. 1

F. 100 count, 8 oz. No. 1

G. 110 count, 7 oz. No. 1

H. 120 count, 6 oz. No. 1

I. US #1, Size A

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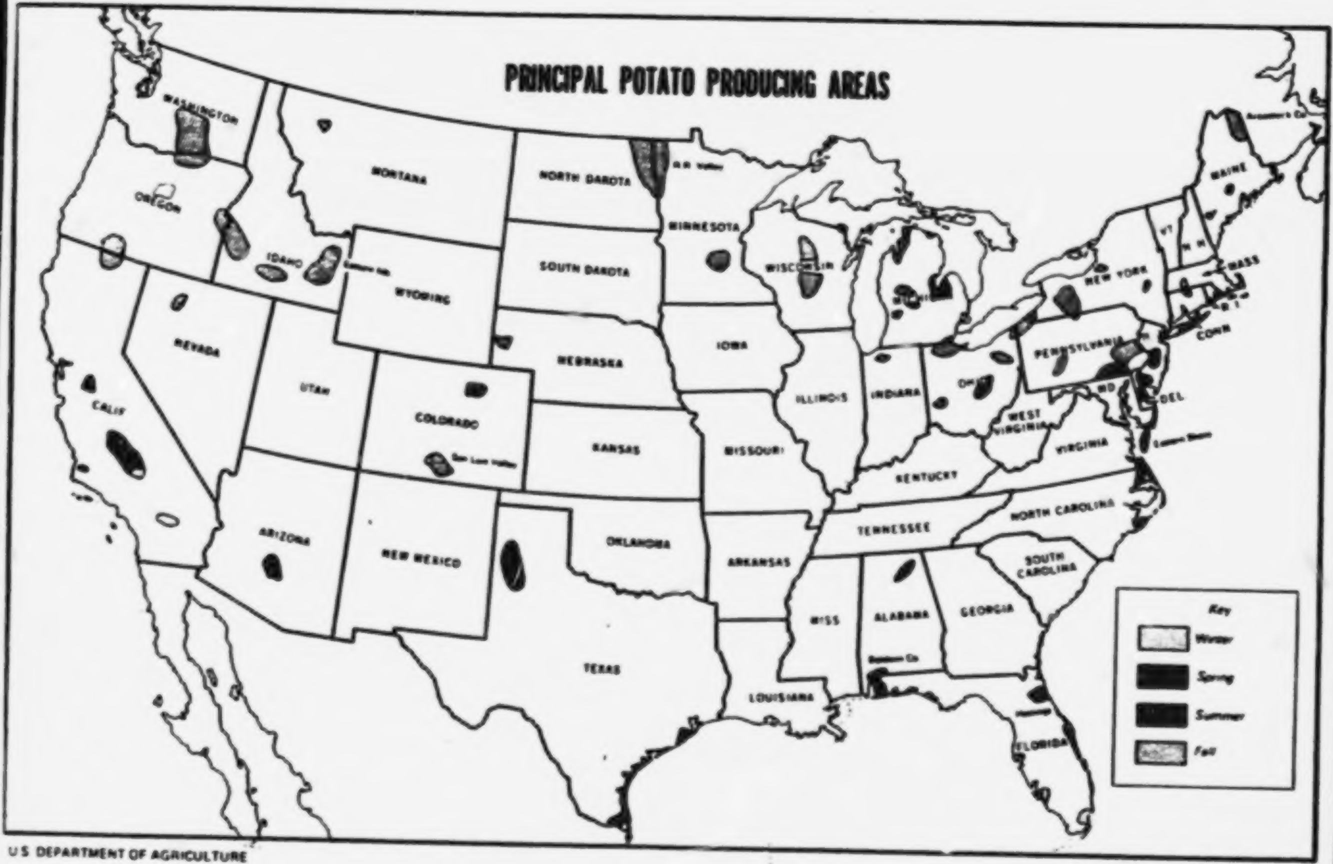


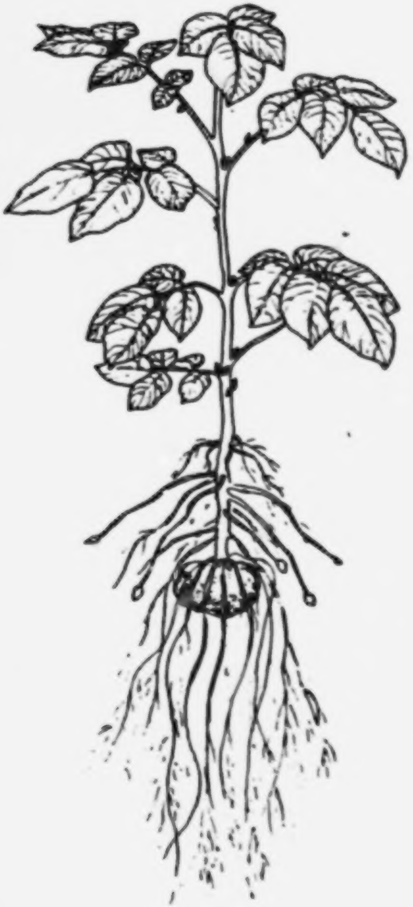
PRINCIPAL POTATO PRODUCING AREAS

WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING
NEVADA
UTAH
CALIF
COLORADO
San Luis Valley
ARIZONA
NEW MEXICO
NORTH DAKOTA
R.R. Valley
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISS
ALABAMA
Baldwin Co
GEORGIA
FLORIDA
Hastings
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
Eastern Shore
PENNSYLVANIA
MD
DEL
NEW YORK
CONN
R I
MASS
VT
N H
MAINE
Aroostook Co
Key
Winter
Spring
Summer
Fall

U.S. DEPARTMENT OF AGRICULTURE

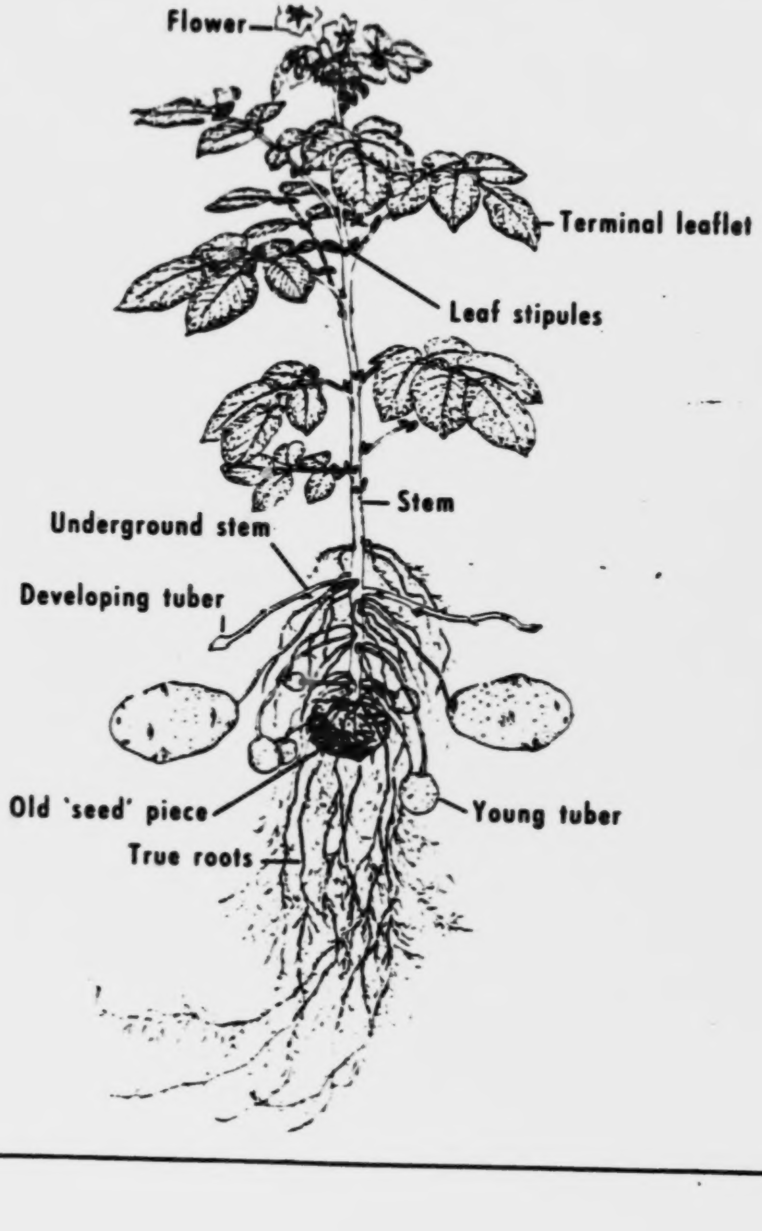
ECONOMIC RESEARCH SERVICE

Leading Potato Producing States

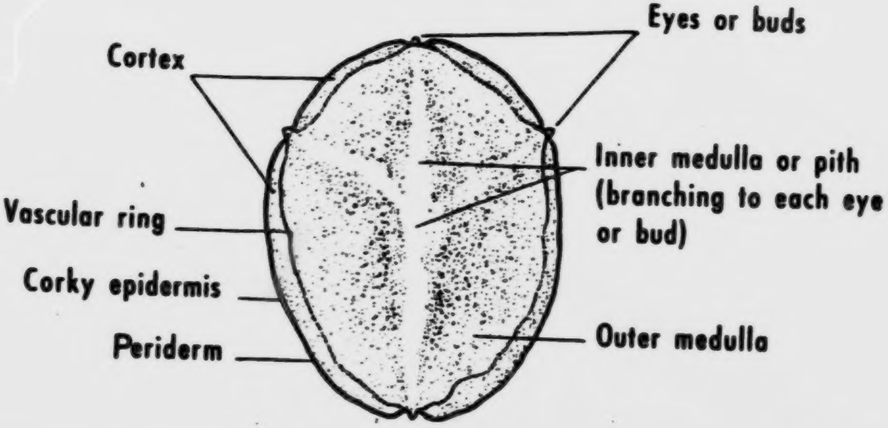


1. Idaho
2. Washington
3. Maine
4. Oregon
5. North Dakota
6. California

Parts of a Potato Plant


Flower
Terminal leaflet
Leaf stipules
Stem
Underground stem
Developing tuber
Old 'seed' piece
Young tuber
True roots

Cross Section of a Potato Tuber


Eyes or buds
Cortex
Inner medulla or pith (branching to each eye or bud)
Vascular ring
Corky epidermis
Periderm
Outer medulla

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CSS 16 24

POTATO PRODUCTION
UNIT 16

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATION FOR POTATOES

NAME ______________________________ SCORE ________

Using the information provided on the soil test report form for Jim Stevens, and University of Idaho CIS #261 - Idaho Fertilizer Guide for Potatoes, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide for more complete directions.

PART I

SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No. ________
Fee: $ ________
Paid: Cash ____ Check ____ Other ____

Name Jim Stevens
Address Power County

County ________
Date ________
Sample Ident ________
Soil Texture ________
Acres Sampled ________
Sample Taken by ________ (grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Potatoes	Anticipate	400cwt	furrow
Previous crop	Wheat	residue returned	40 bu.	
Grown in 19____				
Grown in 19____				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth Cultivation or 0-7	(inches) Other
Soil Reaction - pH	7.0	
Available P (ppm P)	8.2	
Available K (ppm K)	120	
Soil Organic Matter, %	2.4	

NaHCO₃ 1:20 NaOAc 1:5

C. Cation Content ☐ Sample depth 12"

B. Nitrogen Test

Soil depth (inches)	Nitrate ☒ nitrogen ppm N	Ammonium ☒ nitrogen ppm N	Available ☐ moisture (inches)
0-12	6.4	4.1	
12-24	2.4	8.3	
24-36			
36-48			
48-60			
60-72			
Total			

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

Zinc ppm ☒	Manganese ppm ☐	Boron ppm ☐	Sulfate sulfur ppm ☐	Total Salts mmhos ☐	Gypsum Req. alkali soils ☐	Lime Req. acid soils ☐	Other ☐
0.4							

SOIL FERTILITY GUIDE

Pounds per acre N	P₂O₅	P	K₂O	K	Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks: ________

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

GROWER COPY

____
Extension Agricultural Agent

ASSIGNMENT SHEET #1

Part II

A. Considering 20 bushel yield of wheat is equal to one ton of residue returned, answer the following questions:

   1. How many tons of wheat residue were returned to the soil?

   2. How much extra nitrogen will we need to apply to compensate for tie-up by the residue?

B. How deep should the soil sample be taken for the nitrogen test?

C. How deep should the soil sample be taken for the remainder of the tests?

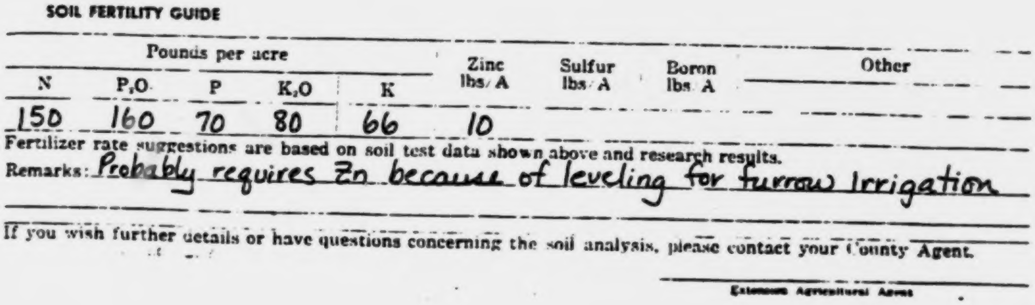
D. What other factors could affect the potatoes ability to get nutrients from the soil (other than level of nutrients in the soil)?

POTATO PRODUCTION
UNIT 16

ANSWERS TO ASSIGNMENT SHEETS

Assignment sheet #1

Part I



SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				
150	160	70	80	66	10			

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks: Probably requires Zn because of leveling for furrow Irrigation

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

Part II

A. 1. 2 tons
   2. 30 lbs.N per acre
B. 24 inches
C. Usually 12 inches, but may be 9 inches
D. Evaluated to satisfaction of instructor

POTATO PRODUCTION
UNIT 16

TEST

NAME____________________________________ SCORE____________

1. Match terms associated with potato production to the correct definitions. Write the correct numbers in the blanks.

1.	Rhizomes	4.	Feathered
2.	Tubers	5.	Eyes
3.	Suberization		

_____a. The healing over of the cut part of the seed

_____b. Skin rubbed off at harvest

_____c. Enlarged tips of rhizome

_____d. Bud areas on tuber that give rise to new stems and roots

_____e. A subterranean stem

2. Select from the following list leading potato producing states. Write an "X" in the blank before each correct answer.

_____a. Maine

_____b. Oregon

_____c. Washington

_____d. North Dakota

_____e. Idaho

_____f. California

3. Discuss the economic importance of potato production to Idaho.

____

____

____

____

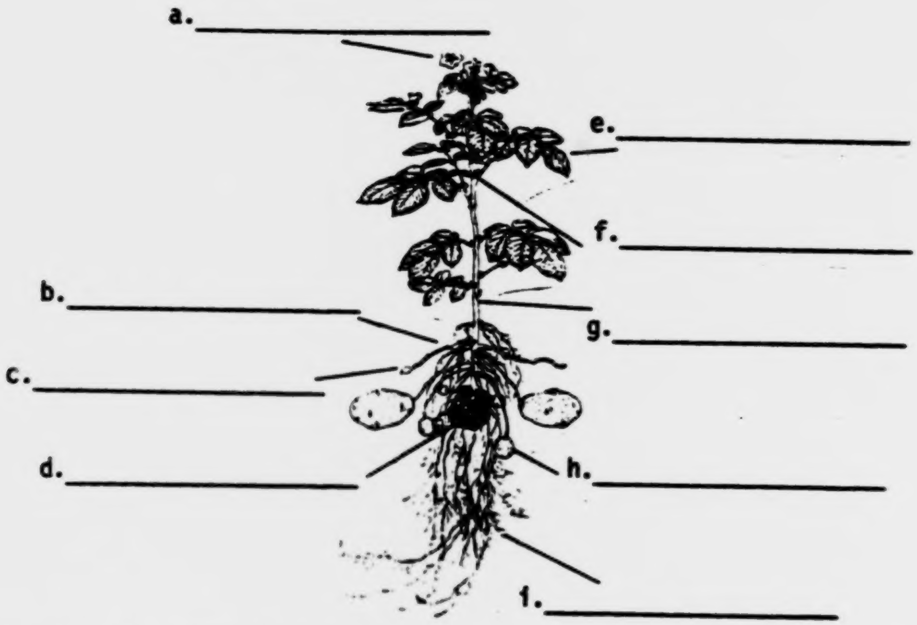
____

____

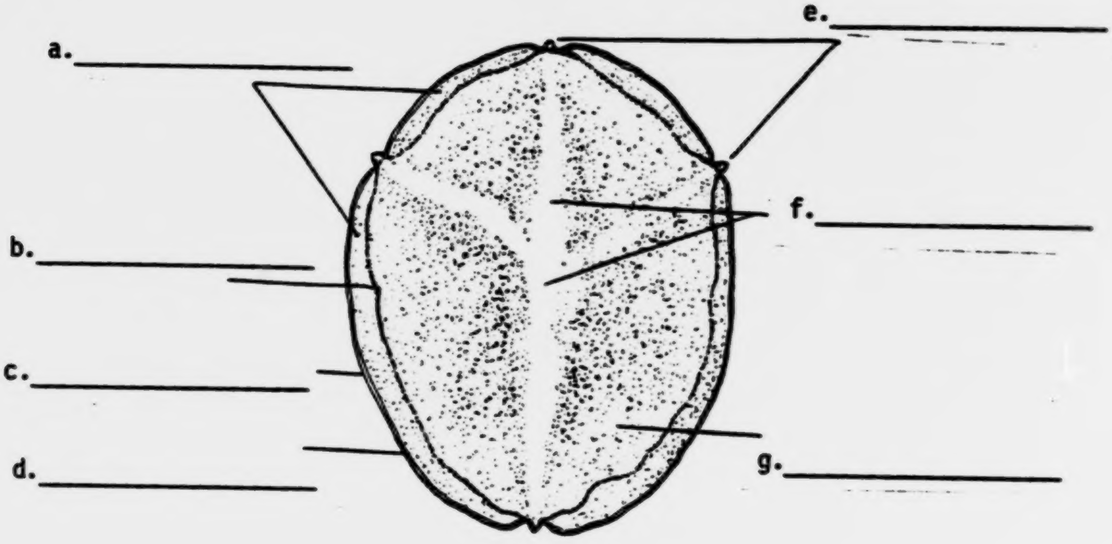
____________________ ____________________

TEST

4. Identify the parts of a potato plant. Write the correct names in the blanks.



5. Identify the parts of a potato tuber. Write the correct names in the blanks.



TEST

6. Select from the following list characteristics of a desirable seedbed. Write an "X" in the blank before each correct answer.

_____a. Fairly level

_____b. Adequate moisture

_____c. Free of weeds

_____d. Loose and mellow

_____e. Free of large clods

7. List three tillage operations involved in seedbed preparation.

a.____

b.____

c.____

8. Name three common varieties of seed.

a.____

b.____

c.____

9. Discuss the major points in selecting and preparing seed.

____

____

____

____

____

____

____

____

____

____

____

____

TEST

10. Name two types of planters.

a.____

b.____

11. Select from the following list factors to consider in planting potatoes. Write an "X" in the blank before each correct answer.

_____a. Rowspacing

_____b. Price of certified seed

_____c. How the potatoes will be marketed

_____d. Depth of seeding

_____e. Seed rates

_____f. Time of planting

12. Select from the following list factors that influence final plant populations. Write an "X" in the blank before each correct answer.

_____a. Germination percentage

_____b. Soil fertility

_____c. Insect and disease damage

_____d. Percentage of bruised potatoes

_____e. Price of nitrogen fertilizer

_____f. Planting rate

_____g. Seedling vigor

_____h. Adequate moisture

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CSS 16 33

TEST

13. Using the information provided on the soil test report for I.M. Dirty, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide in making recommendations. Show all work.

SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No.____

Fee: $____

Paid: Cash____ Check____ Other____

Name I.M. Dirty

Address Parma, ID.

County____

Date____

Sample Ident.____

Soil Texture____

Acres Sampled____

Sample Taken by____
(grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Potatoes	Anticipate	500cwt	Furrow
Previous crop	Wheat	residue returned		100 bu.
Grown in 19____				
Grown in 19____				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth	(inches)
	Cultivation or 0-7	Other
Soil Reaction - pH	7.4	
Available P (ppm P)	6.0	
Available K (ppm K)	111	
Soil Organic Matter, %	2.4	

NaHCO₃ 1:20 NaOAc 1:5

C. Cation Content ☐ Sample depth 12"

B. Nitrogen Test

Soil depth (inches)	Nitrate ☒ nitrogen ppm N	Ammonium ☒ nitrogen ppm N	Available ☐ moisture (inches)
0-12	6.4	4.1	
12-24	3.4	7.1	
24-36			
36-48			
48-60			
60-72			
Total			

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

☒ Zinc ppm	☐ Manganese ppm	☐ Boron ppm	☐ Sulfate sulfur ppm	☐ Total Salts mmhos	☐ Gypsum Req. alkali soils	☐ Lime Req. acid soils	Other ☐
0.4							

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P₂O₅	P	K₂O	K				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:____

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

____
Extension Agricultural Agent

TEST

14. Name two potato diseases.

a.____________________

b.____________________

15. Name two harmful insects of potatoes.

a.____________________

b.____________________

16. Discuss how weeds compete with potatoes.

____

____

____

____

____

____

____

17. List three ways weeds cause losses in potato production.

a.____________________

b.____________________

c.____________________

18. Match the general categories of weeds to the correct description. Write the correct numbers in the blanks.

1. Annual
2. Perennial
3. Broadleaf
4. Grass

_____a. Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots

_____b. Live for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

_____c. Complete life cycle within the period of one year

_____d. Plant with longer, narrower leaves with parallel veination; monocots

TEST

19. Name three methods of weed control.

a.____________________

b.____________________

c.____________________

20. Select from the following list herbicides used to control weeds in potatoes. Write an "X" in the blank before each correct answer.

_____a. Treflan

_____b. Parathion

_____c. Sencor or Lexone

_____d. Eptam

_____e. 2,4-D

_____f. Vertac General

21. List two types of cultivation.

a.____________________

b.____________________

22. Select from the following list reasons for killing vines prior to harvest. Write an "X" in the blank before each correct answer.

_____a. Increases yield per acre

_____b. Toughens the skin

_____c. Hastens maturity

_____d. Stops growth

_____e. Reduces disease in seed fields

_____f. Retards the growth of sprouts

23. Name two ways to kill potato vines.

a.____________________

b.____________________

TEST

24. Select from the following list methods of handling potatoes to reduce bruising. Write an "X" in the blank before each correct answer.

_____a. Modify harvesting equipment to reduce bruising

_____b. Storage at proper relative humidity

_____c. Use rubber coated chains

_____d. Drop distance held to a minimum

_____e. Correct and adequate distribution of airflow in storage

_____f. Do not step on or kick potatoes

25. Tell what a proper potato storage environment consists of and how it is provided.

____
____
____
____
____
____
____
____

26. List four uses of potatoes.

a.____
b.____
c.____
d.____

27. Name three grades of potatoes for fresh pack.

a.____
b.____
c.____

TEST

28. Discuss the sizing of potatoes for fresh pack.

POTATO PRODUCTION
UNIT 16

ANSWERS TO TEST

1. a. 3
   b. 4
   c. 2
   d. 5
   e. 1

2. a, b, c, d, e, f

3. Evaluated to satisfaction of instructor

4. a. Flower
   b. Leaflets
   c. Stipules
   d. Stem
   e. Roots
   f. Tuber

5. a. Corky epidermis
   b. Cortex
   c. Vascular ring
   d. Inner medulla
   e. Outer medulla
   f. Eyes or buds

6. a, b, c, d, e

7. Evaluated to satisfaction of instructor

8. Answer should include any three of the following
   a. Russett Burbank
   b. Butte
   c. Norgold
   d. Lemhi
   e. Nooksack

9. Evaluated to satisfaction of instructor

10. a. Picker-type
    b. Cup-type

11. a, c, d, e, f

12. a, b, c, f, g, h

13.

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs A	Sulfur lbs A	Boron lbs A	Other
N	P_2O_5	P	K_2O	K				
230	160	70	80	66	10	—	—	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

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TEST

14. Answer should include any two of the following

a.	Early blight	e.	Common scab
b.	Early dying	f.	Rhizoctonia
c.	Potato ring rot	g.	Translucent-end
d.	Blackleg		

15. Answer should include any two of the following

    a. Colorado potato beetle
    b. Wireworms
    c. Green peach aphid

16. Evaluated to satisfaction of instructor

17. a. Decreased yield
    b. Decreased crop quality
    c. Cost of control activities

18. a. 3 b. 2 c. 1 d. 4

19. a. Cultural b. Mechanical c. Chemical

20. a, c, d, f

21. a. Hilling b. Inter-row

22. b, c, d, e

23. Answer should include any two of the following

a.	Chemical sprays	d.	Rotary mowers
b.	Roller	e.	Flaming
c.	Vine beater		

24. a, c, d, f

25. Evaluated to satisfaction of instructor

26. Answer should include any four of the following

a.	Fresh pack	d.	Animal feed
b.	Processed	e.	Alcohol production
c.	Certified seed		

27. a. No. 1 b. No. 2 c. Culls

28. Evaluated to satisfaction of instructor

SMALL GRAIN PRODUCTION
UNIT 17

UNIT OBJECTIVE

After completing this unit, the student should be able to describe small grain production techniques involved in seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with small grain production to the correct definitions.
2. List three uses of small grains.
3. Select from a list leading wheat producing states.
4. Discuss the economic importance of small grain production to Idaho.
5. Identify the parts of a wheat plant.
6. Arrange in order the stages of growth of small grains.
7. Select from a list characterisitics of a desirable seedbed.
8. List three tillage operations involved in seedbed preparation.
9. Name two types of grain drills.
10. Name two classes of wheat and what they are used for.
11. List two common varieties of seed for soft white spring wheat and soft white winter wheat.
12. Select from a list factors to consider in planting small grains.
13. Select from a list factors that influence final plant populations.
14. Calculate fertilizer requirements for small grains.
15. Name two small grain diseases.
16. Name one harmful insect of small grains.
17. Discuss how weeds compete with small grains.

OBJECTIVE SHEET

18. List three ways weeds cause losses in small grain production.
19. Match the general categories of weeds to the correct description.
20. Name three methods of weed control.
21. Select from a list herbicides used to control weeds in small grains.
22. Discuss approved practices for harvesting and storing small grains.
23. List three qualities of a good storage facility for small grains.
24. Match the types of grain markets to the correct description.
25. List two main factors in grading grain.

SMALL GRAIN PRODUCTION
UNIT 17

SUGGESTED ACTIVITIES

I. Suggested activities

- A. Order materials to supplement unit
  - 1. Literature
    - a. Oats, instructional unit available from: Agri-Farm Publications, Inc., 1019 Market St., Gowrie, IA, 50543; approx. cost $7.50; order no. 210; Also available: oat production guide, approx. cost $4.80, order no. 2105.
    - b. Oats Production, 17 transparency masters available from: IAVIM, 208 Davidson Hall, Iowa State Univ., Ames, IA, 50011; approx. cost $2.25, order no. 516
  - 2. Filmstrips, slideshows, etc.
    - a. "Diseases of Wheat", filmstrip and study guide available from: Ohio Agriculture Education Curriculum Materials Center, Ohio State University, Columbus, OH, 43210; approx. cost $7.60, order no. 110X.
  - 3. Films
- B. Make transparencies
- C. Provide students with objective sheet
- D. Provide students with information and assignment sheets
- E. Discuss unit and specific objectives
- F. Discuss information and assignment sheets
- G. Do a community survey of small grain production and publish the results in local newspaper
- H. Calibrate a grain drill as a class project

SUGGESTED ACTIVITIES

- I. Invite resource person to speak on small grain production
- J. Arrange for a field trip to a local elevator to discuss storage and marketing of grains
- K. Give test
- L. Reteach if necessary
- M. Retest

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Transparency masters
  1. TM 1--Spring wheat harvested
  2. TM 2--Winter wheat harvested
  3. TM 3--Parts of a wheat plant
  4. TM 4--Wheat germination and seedling growth
  5. TM 5--Vegetative growth stages of wheat
  6. TM 6--Heading stage of wheat
  7. TM 7--Classes of wheat
- E. Assignment sheets
  1. AS 1--Making fertilizer recommendations for wheat
- F. Answers to assignment sheets
- G. Test
- H. Answers to test

III. Unit references

A. Delorit, R.J. et al. Crop Production, 4th edition. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

B. Wesenberg, D.M., et al. Producing Malting Barley in Idaho. University of Idaho. Current Information Series No. 276, Moscow, ID: 1978.

SUGGESTED ACTIVITIES

C. Roylance, H.B. Producing Small Grains Under Irrigation in Southern Idaho. University of Idaho. C.I.S. no. 266. Moscow, ID: 1975.

D. Harris, M.S. Diseases of Cereal Crops in Washington. Washington State University. Extension Bulletin no. 559. Pullman, WA: 1964.

SMALL GRAIN PRODUCTION
UNIT 17

INFORMATION SHEET

I. Terms and definitions

A. Cool-season crop--Makes best growth under relatively cool conditions; are generally damaged by hot weather; includes wheat, barley, and oats

B. Vernalization--Cold treatment of a plant, plant part, or seed to initiate reproduction

C. Long-day plant--Requires relatively short nights for the formation of flowers; short days increase vegetative growth

D. Coleoptile--Sheath which covers the first leaf of grass seedlings during emergence

E. Crop residue--Plant material, e.g. wheat stubble, which is left on or in ground after harvest

F. Erosion--Removal of topsoil by tillage, wind and/or water

G. Stubble mulching--Tillage beneath stubble without covering all of the residue

H. Strip cropping--Alternate strips of crop and summer fallow to reduce erosion and conserve moisture

I. Contour cropping--Planting and cultivating parallel with the lay of the land to prevent erosion

J. No-Till--System of reduced tillage where cultivation and seeding are accomplished at the same time

K. Minimum tillage--Any practice which reduces the number of tillage operations on a field

II. Uses of small grains

A. Baking flour

B. Livestock feed

C. Breakfast cereal

D. Hay

E. Pasture

F. Protein supplements

INFORMATION SHEET

G. Glue products

H. Bedding (straw)

I. Malt

III. Leading small grain producing states (Transparencies #1 and #2)

A. Wheat

1. Kansas
2. North Dakota
3. Washington
4. Texas
5. Oklahoma
6. Montana

B. Barley

1. North Dakota
2. Montana
3. Idaho
4. Washington
5. Minnesota
6. California

C. Oats

1. South Dakota
2. Minnesota
3. North Dakota
4. Wisconsin
5. Iowa
6. Texas

INFORMATION SHEET

IV. Economic importance of small grain production to Idaho (1984)

A. Wheat

1. Idaho ranks 9th in production of all wheat in U.S.
2. 1,305,000 acres harvested
3. Total annual production of 91,710,000 bushels
4. Average yield of 70.3 bushels/acre
5. Annual value of $317,375,000

B. Barley

1. Idaho ranks 3rd in production of barley in U.S.
2. 1,010,000 acres harvested
3. Total annual production of 65,650,000 bushels
4. Average yield of 65.0 bushels/acre
5. Annual value of $187,103,000

C. Oats

1. 48,000 acres harvested
2. Total annual production of 3,648,000 bushels
3. Average yield of 76.0 bushels/acre

V. Parts of a wheat plant (Transparency #3)

A. Head or flower

B. Flag leaf

C. Leaves

D. Stem

E. Roots

VI. Stages of growth of small grains (Transparencies #4, #5, and #6)

A. Germination

B. Seedling

C. Tillering or Stooling

INFORMATION SHEET

- D. Jointing
- E. Boot
- F. Heading
- G. Flowering
- H. Milk
- I. Soft dough
- J. Hard dough
- K. Mature

VII. Characteristics of a desirable seedbed

- A. Loose and mellow
- B. Fairly level
- C. Free of large clods

  (Note: The clod size needed will be determined by erosion potential. For high erosion potential, leave larger size clod. For low erosion potential, leave smaller size clod.)
- D. Adequate available moisture
- E. Free of weeds

VIII. Tillage operations involved in seedbed preparation

- A. Primary tillage
  - 1. Moldboard plow
    - a. Time--Spring or fall
    - b. Depth--6 to 8 inches
    - c. Moisture needed
  - 2. Ripper (chisel plow)
    - a. Time--Fall
    - b. Depth--12 to 14 inches
    - c. Dry conditions needed

INFORMATION SHEET

B. Secondary tillage

1. Disk

a. Time--Spring

b. Depth--3 to 4 inches

2. Harrow

a. Time--Spring

b. Depth--3 to 4 inches

3. Roller

a. Time--Spring

b. Depth--Surface

IX. Types of grain drills

A. End-wheel drill--Wheels on sides support and drive the seed metering mechanisms

B. Press-wheel drill--Press-wheel gangs mounted on rear of the drill; press wheels act to firm the soil over the seed, drive the metering mechanism, and support the rear of the drill

(Note: Planting done with grain drills is called solid planting. It is called this because the rows are too close to permit cultivating or other cultural practices between them. Solid planting is normally used for small grains, grasses, and legumes.)

X. Classes of wheat (Transparency #7)

A. Hard red spring wheat

1. Produced mainly in North Dakota, South Dakota, Minnesota, Nebraska and Montana

2. Use: bread flour

3. Grown in southeastern Idaho

INFORMATION SHEET

- B. Hard red winter wheat
  - 1. Produced mainly in Kansas, Oklahoma, and Texas
  - 2. Use: bread flour
  - 3. Grown in southeastern Idaho
- C. Soft White Wheat
  - 1. Produced mainly in western U.S.
  - 2. Use: flour for pastries, cakes, cookies, breakfast foods and all-purpose flour
  - 3. Primary class of wheat raised in Idaho
    - a. Northern Idaho--98%
    - b. Southwestern Idaho--99%
    - c. South central Idaho--99%
- D. Soft red wheat
  - 1. Produced mainly in Ohio, Missouri, Indiana, Pennsylvania and Illinois (areas of more than 30" of rainfall)
  - 2. Use: Same as soft white wheat
  - 3. None in Idaho
- E. Durum wheats (Durum and red durum)
  - 1. Produced mainly in North Dakota, South Dakota, Minnesota, and Montana (spring wheat, similar to hard red spring)
  - 2. Use: Noodles, macaroni, spaghetti and similar products
  - 3. Small amount grown in Idaho

XI. Common varieties

- A. Soft white winter wheat
  - 1. Daws
  - 2. Nugaines
  - 3. Stephens
  - 4. Hill 81
  - 5. Lewjain

INFORMATION SHEET

B. Soft white spring wheat
    1. Fielder
    2. Twin
    3. Fieldwin

C. Hard red spring wheat
    1. Borah
    2. Peak 72
    3. Fremont

D. Feed barley, 2-row spring
    1. Caribou
    2. Otis

E. Feed barley, 6-row spring
    1. Steptoe
    2. Steveland
    3. Woodvale
    4. Gem
    5. Vale 70

F. Feed barley, 6-row winter
    1. Schuyler
    2. Luther
    3. Kamiak

G. Malting barley, 6-row
    1. Traill
    2. Larker
    3. Karl

INFORMATION SHEET

H. Malting barley, 2-row

1. Klages
2. Shabet
3. Piroline
4. Vanguard
5. Moravian III

I. Oats

1. Cayuse
2. Park

XII. Factors to consider in planting small grains

A. Time of planting

B. Seeding depth—1 to 2 inches

(Note: Deeper planting is practiced on sandy soils or when limited amounts of moisture are available.)

C. Seeding rate

(Note: As soil and climatic conditions improve the more seeds per foot of row can be produced. Average planting rates are 60-80 lbs. acre for winter wheat, 80-150 lbs. acre for spring wheat, and 80-130 lbs. acre for barley.)

D. Rowspacing--6 to 7 inches.

XIII. Factors that influence final plant populations

A. Planting rate

B. Planting depth

C. Germination percentage

D. Vigor of seedling

E. Availability of plant nutrients

F. Moisture availability

G. Competition from weeds

H. Damage from disease and insects

INFORMATION SHEET

XIV. Fertilizer requirements

A. Soil testing

(Note: Use soil test results in conjunction with University of Idaho Fertilizer Guides. Nutrients of concern for soil test include nitrogen, phosphorus, potassium, and sulphur. Applications of other nutrients have not been shown to be responsive or economical and are not suggested.)

XV. Small grain diseases

A. Leaf rust

1. Crop affected--Wheat, barley
2. Symptoms--Appears as small, round to oval, orange-yellow dusty pustules on the leaves and sheaths; resistant varieties show only small yellow flecks or spots
3. Causal agent--Fungus; requires alternate host
4. Methods of control--At present, the best control is in the use of resistant varieties; planting early or using early maturing varieties may help; chemical control (Bayleton)

B. Stem Rust

1. Crop affected--Wheat, oats, barley
2. Symptoms--Appears as oblong, reddish-brown pustules on stems, leaves, sheaths, and heads; as wheat matures, the pustules gradually turn black
3. Causal agent--Fungus; requires alternate host
4. Methods of control
    a. Plant resistant, early maturing varieties
    b. Plant spring grains as early as possible
    c. Control alternate host

INFORMATION SHEET

C. Powdery mildew

1. Crop affected--Wheat, barley
2. Symptoms--White or brownish gray powder or mold on leaf surface or spikelet
3. Causal agent--Fungus; survives on living and dead plants
4. Methods of control--At present, the best control is in he use of resistant varieties; chemical control (Bayleton)

D. Seed decay and seedling blight

1. Crop affected--Wheat, oats, barley
2. Symptoms--Seeds decay before or after germination; thin stands; plants weak and stunted
3. Causal agent--Several soil-borne fungi
4. Control--Chemical seed treatment

E. Root, crown, and foot rots

1. Crop affected--Mostly wheat, but also barley
2. Symptoms--Roots brown to black and sparse; crown and foot discolored ; stems often shortened; heads ripen prematurely; kernels shriveled; stems sometimes fall over or lodge
3. Causal agent--Several soil-borne fungi
4. Control--Crop rotation with non-cereal crop; chemical seed treatment; balanced fertility, particularly nitrogen and phosphorus; prevent moisture stress

F. Smuts

1. Crop affected--The different smuts are specific to either wheat, barley, or oats
2. Symptoms--Kernels are replaced by a brown to black powdery mass of smut spores
3. Causal agent--Various species of smut fungi
4. Control--Resistant varieties; chemical seed treatment

INFORMATION SHEET

G. Barley yellow dwarf virus

1. Crop affected--Wheat, barley, oats

2. Symptoms--Plants stunted; leaves of wheat are yellow to reddish purple, leaves of barley are yellow, leaves of oats are reddish; kernels may be shriveled or absent

3. Causal agent--A virus transmitted by aphids

4. Control--Seed winter cereals late in the fall and spring cereals early in the spring; maintain adequate moisture and nitrogen during the growing season

H. Stripe rust

1. Crop affected--Wheat

2. Symptoms--Orange yellow stripes appear on leaves, leaf sheaths, and heads

3. Causal agent--Fungus; does not require an alternate host, but survives the winter on winter wheat

4. Control--Resistant varieties; chemical control (Bayleton)

XVI. Insects affecting small grain production

A. Greenbug

1. Description--Adult is usually pale green, wingless form with darker green strip down the center of it's back (an aphid)

2. Damage--Feeds on the plant's fluids, transmits barley yellow dwarf virus and other disease-causing organisms

3. Methods of control

a. Insecticides--Use insecticide such as Malathion to control greenbug

XVII. Weed competition with small grains

A. Competition for water

B. Competition for nutrients

C. Competition for light

(Note: Small grains and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

INFORMATION SHEET

XVIII. Losses caused by weeds

- A. Decreased yield
- B. Decreased crop quality
- C. Cost of control activities

XIX. General categories of weeds

- A. Annual--Complete life cycle within the period of one year

  (Note: Wild oats, lambsquarter, and redroot pigweed are examples.)

- B. Perennial--Live for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

  (Note: Canada thistle, field bindweed, and russian knapweed are examples.)

- C. Broadleaf--Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots
- D. Grass--Plants with longer, narrower leaves with parallel veination; monocots

XX. Methods of weed control

- A. Cultural

  (Note: Wheat and barley are excellent competitors with weeds.)

- B. Mechanical

  (Note: Mechanical weed control in small grains is restricted to pre-plant tillage practices because of narrow rowspacing.)

- C. Chemical

  (Note: A wide spectrum of chemicals are available for use on small grains for weed control.)

INFORMATION SHEET

XXI. Control weeds in small grains with herbicides

(Note: Before you use herbicides, read and understand the directions on the container label. Use and follow directions given on label. Refer to 1984 University of Idaho Weed Control Handbook for further helpful hints.)

A. Weed problem--Wild oats

1. Avadex (diallate)
2. Far-go (triallate)
3. Avenge (difenzoquat)
4. Carbyne (barban)
5. Hoelon (diclofop)

B. Weed problem--Broadleaf annuals in fall or spring-seeded wheat

1. 2,4-D
2. MCPA
3. Brominal (bromoxynil)
4. Glean (chlorsulfuron)

C. Weed problem--Annual broadleaf and grass

1. Premerge 3 (dinoseb)
2. Vertac (dinoseb)
3. Paraquat CL (paraquat)
4. Roundup (glyphosphate)

D. Weed problem--Annual broadleaves and grasses in fall planted, non-irrigated wheat only

1. Karmex (diuron)
2. Lorox (linuron)
3. Sencor (metribuzin)
4. Treflan (trifluralin)

INFORMATION SHEET

E. Weed problem--Perennial broadleaf

1. 2,4-D

2. Banvel (dicamba)

3. Roundup (glyphosphate)

4. Tordon (picloram)

5. Glean (chlorsulfuron)

XXII. Harvesting and storing small grains

A. Practically all small grains in the United States are harvested with the combine

B. Test wheat grain for moisture and harvest for storage when moisture is below 14 percent

C. Properly adjust the combine to prevent harvesting losses; always stop the combine before cleaning if clogged or making other adjustments

D. Store the grain in a dry, vermin-proof bin until marketed or fed

E. Clean and spray all storage bins prior to harvest

(Note: If the small grain crop is to be used as a forage crop or other use, methods of harvesting and storing will change accordingly.)

XXIII. Qualities of a good storage facility

A. Weather-proof

B. Rodent-proof

C. Constructed of easy-to-clean material

XXIV. Grain markets

A. Cash market--Operates in same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold

B. Futures market--Forward contracting to purchase or deliver a certain amount of grain on a given date at a given price

(Note: This ensures the producer of a market for his grain and reduces the risk of declining market prices. This ensures the buyer of delivery of grain at a certain time and reduces the risk of rising market prices.)

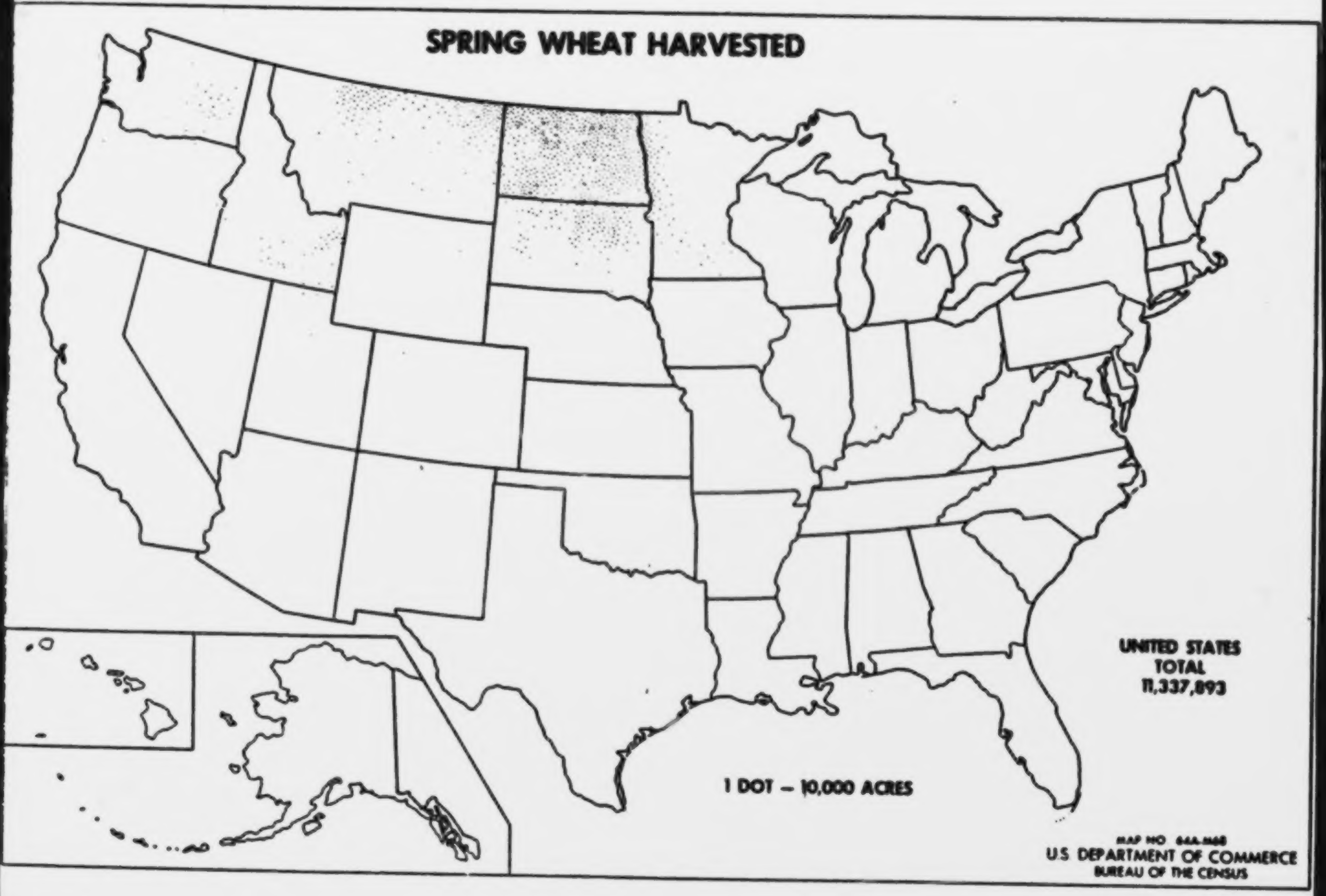
INFORMATION SHEET

XXV. Main factors in grading grain

A. Minimum weight per bushel

B. Maximum percentage of damaged kernels

C. Maximum percentage of foreign matter



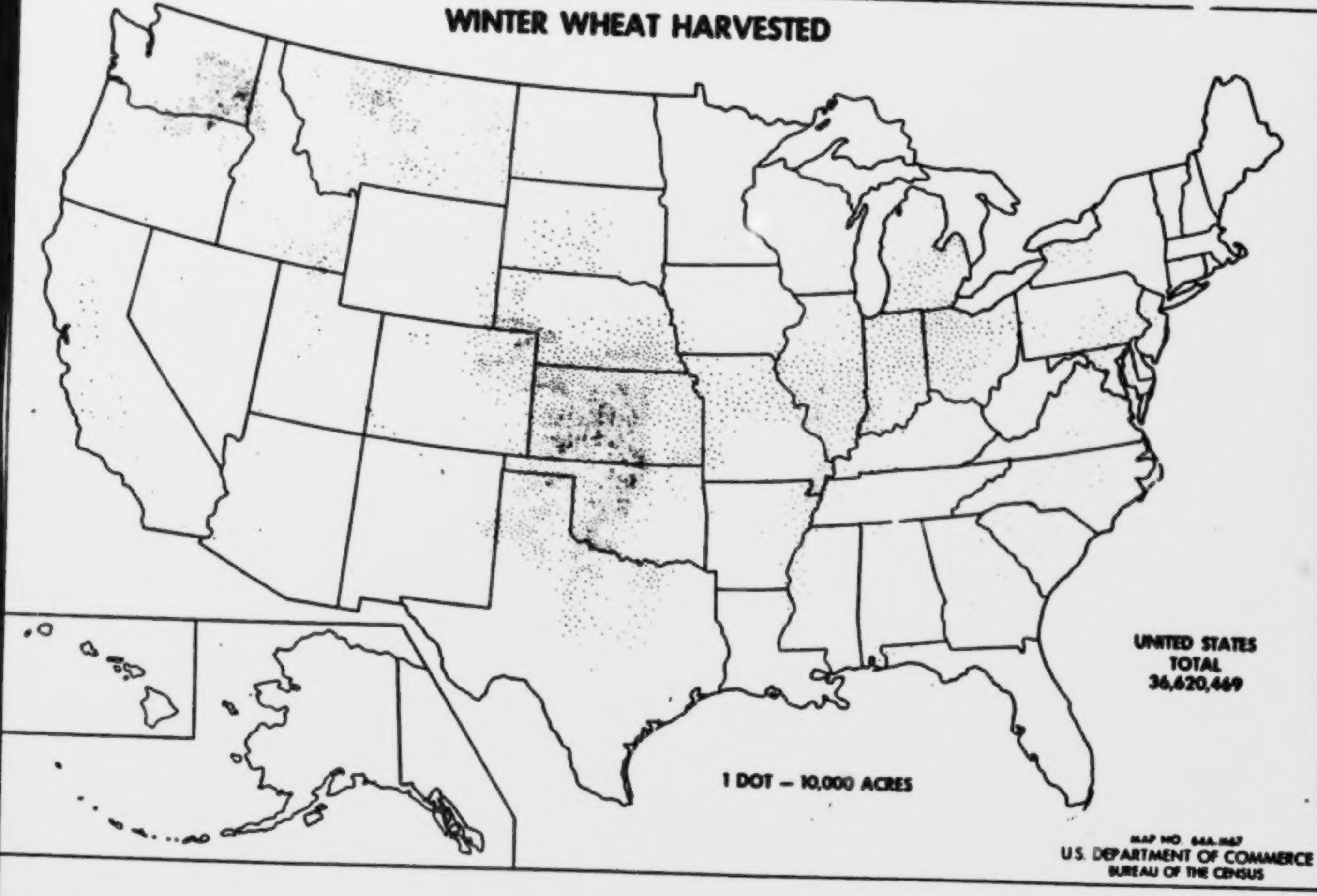
SPRING WHEAT HARVESTED

UNITED STATES
TOTAL
11,337,893

1 DOT – 10,000 ACRES

MAP NO 64A-M48
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

WINTER WHEAT HARVESTED

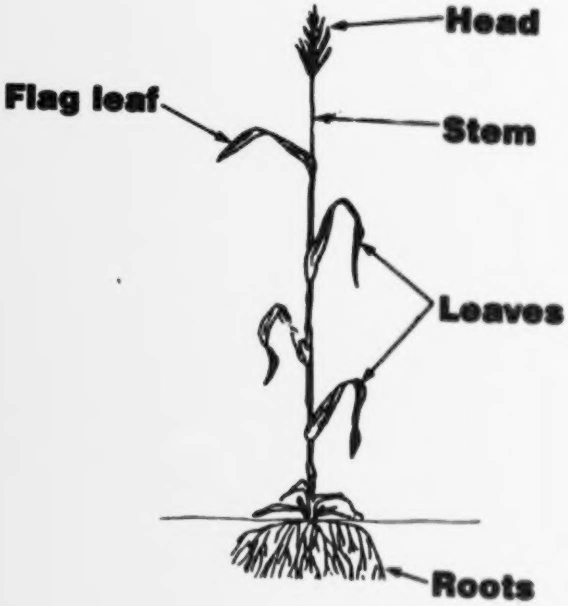


UNITED STATES
TOTAL
36,620,469

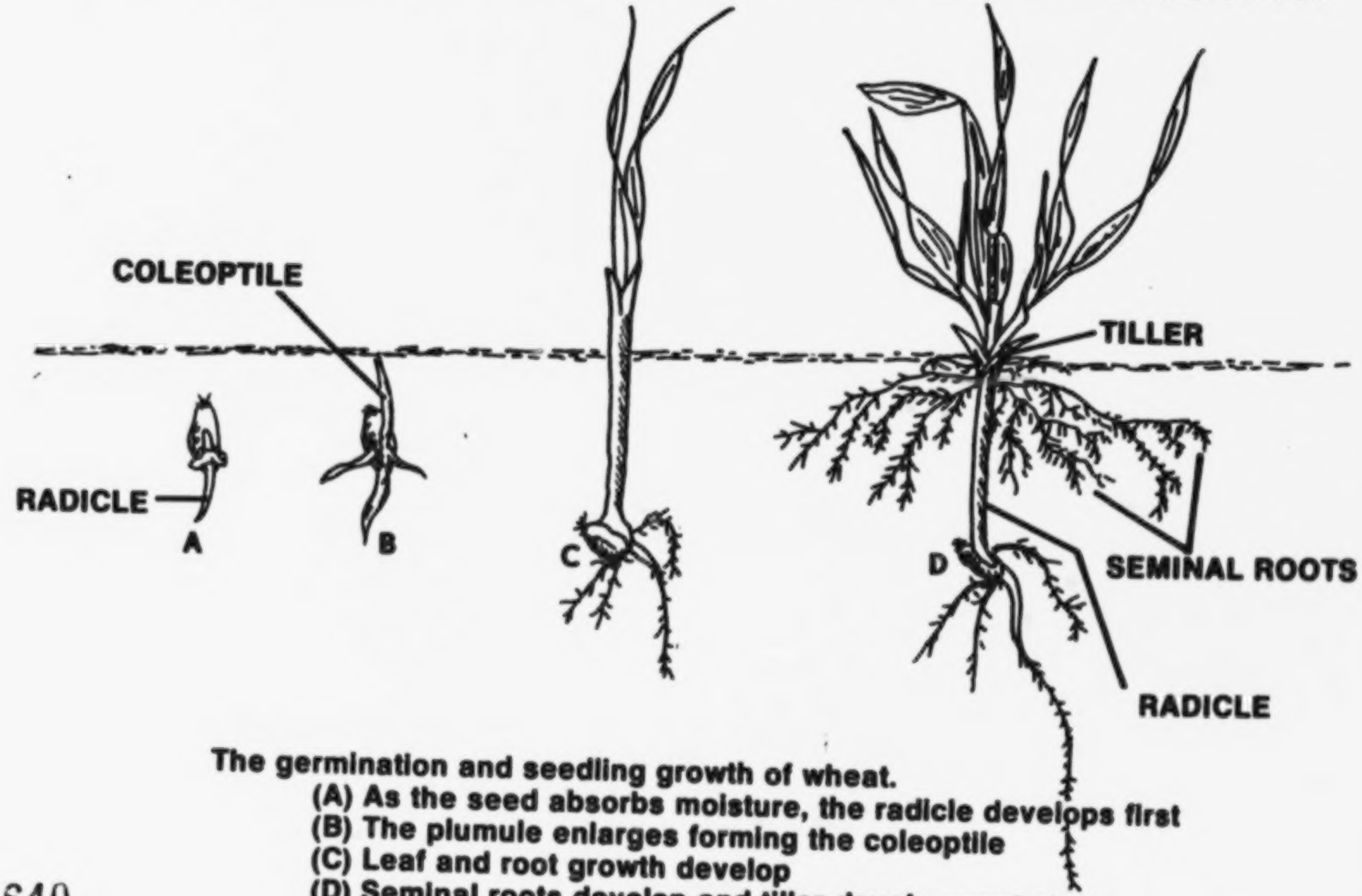
1 DOT – 10,000 ACRES

MAP NO. 64A-M67
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Parts of a Wheat Plant


Head
Flag leaf
Stem
Leaves
Roots

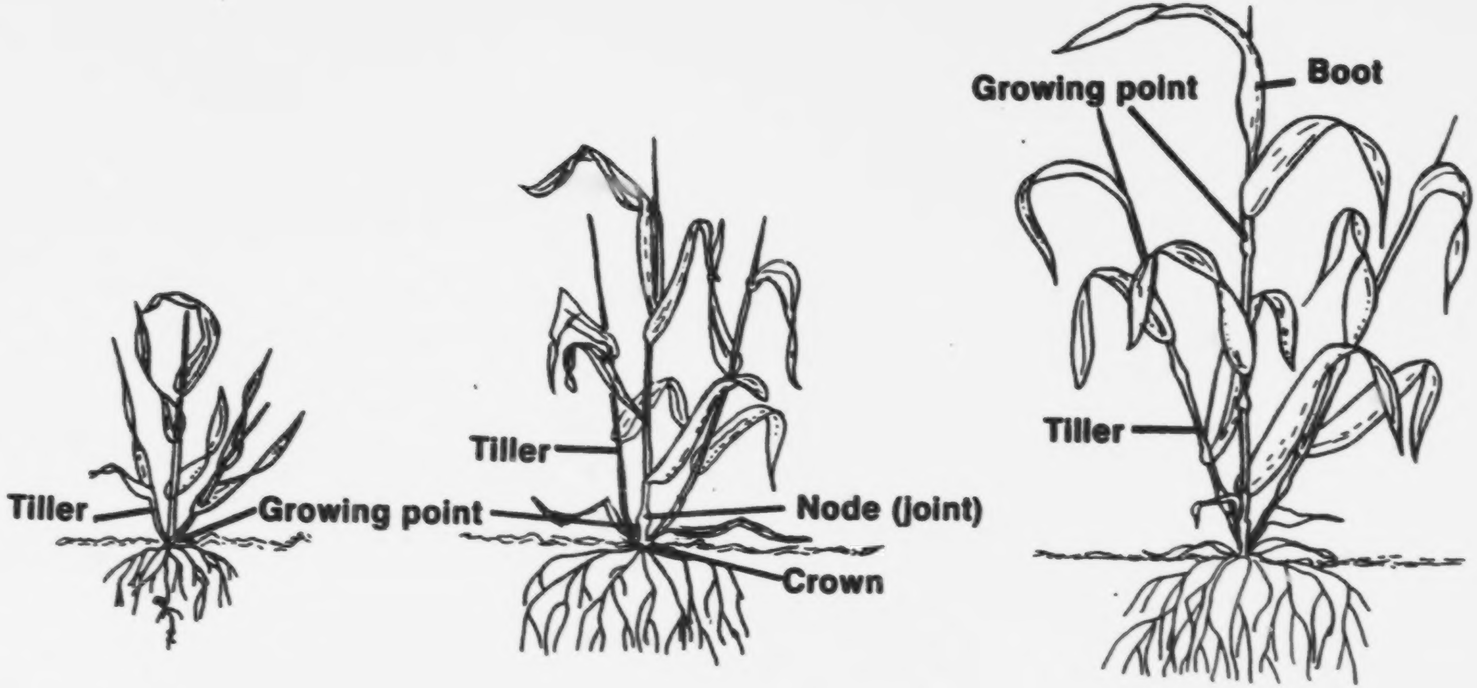
WHEAT GERMINATION AND SEEDLING GROWTH


COLEOPTILE
RADICLE
A
B
C
D
TILLER
SEMINAL ROOTS
RADICLE

The germination and seedling growth of wheat.

(A) As the seed absorbs moisture, the radicle develops first
(B) The plumule enlarges forming the coleoptile
(C) Leaf and root growth develop
(D) Seminal roots develop and tiller development starts

VEGETATIVE GROWTH STAGES OF WHEAT


Tiller
Growing point
Tiller
Growing point
Node (joint)
Crown
Growing point
Boot
Tiller

TM #5

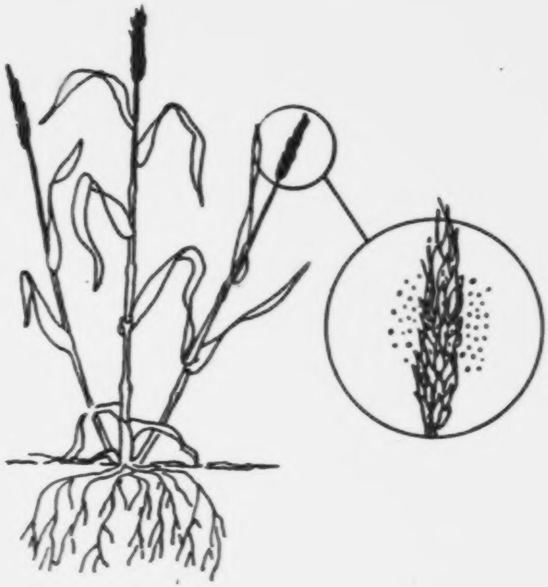
TILLERING STAGE

JOINT STAGE

BOOT STAGE

CSS 17 25

Heading Stage of Wheat



Classes of Wheat

1. Hard Red Spring Wheat
2. Hard Red Winter Wheat
3. Soft White Wheat
4. Soft Red Wheat
5. Durum Wheat

CSS 17 27

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CSS 17 28

SMALL GRAIN PRODUCTION
UNIT 17

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR WHEAT

NAME______________________________ SCORE__________

Using the information provided on the soil test report for Tommy Doe, and University of Idaho CIS #453 - North Idaho Fertilizer Guide for Wheat, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide for more complete directions.

PART I

SOIL TEST REPORT

Name Tommy Doe
Address Lewis County

DO NOT WRITE IN THIS SPACE

Lab. No.________
Fee: $________
Paid: Cash____ Check____ Other____

County Lewis, eroded soil
Date________
Sample Ident________
Soil Texture________
Acres Sampled________
Sample Taken by________ (grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Winter Wheat		Pot. 100 bu.	
Previous crop	Peas	residue	returned	
Grown in 19___				
Grown in 19___				

LABORATORY DATA · Check Test Desired ☒

A. Standard Test ☒

	Sampling depth: Cultivation or 0-7	(inches): Other
Soil Reaction - pH	6.7	
Available P (ppm P)	4.5	
Available K (ppm K)	145	
Soil Organic Matter, %	4.0	

NaHCO$_3$ 1:20 NaOAc 1:5

C. Cation Content ☐ Sample depth 12"

B. Nitrogen Test

Soil depth (inches)	Nitrate ☒ nitrogen ppm N	Ammonium ☒ nitrogen ppm N	Available ☐ moisture (inches)
0-12	8	1	
12-24	3	1	
24-36	2	1	
36-48			
48-60			
60-72			
Total			

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

☐ Zinc ppm	☐ Manganese ppm	☒ Boron ppm	☒ Sulfate sulfur ppm	☐ Total Salts mmhos	☐ Gypsum Req. alkali soils	☐ Lime Req. acid soils	☐ Other
		0.4	12				

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:________

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

GROWER COPY

____
Extension Agricultural Agent

ASSIGNMENT SHEET #1

PART II

A. How many pounds of available nitrogen are necessary to produce one bushel of wheat?

B. What is mineralizable nitrogen? How many pounds of mineralizable nitrogen will be released in this situation?

C. Make the following calculations.

Total nitrogen needed ________
Minus mineralizable nitrogen ________
Minus soil test nitrogen (lb/acre) ________

Nitrogen fertilizer required (lb/acre) ________

D. How deep should the soil sample be taken for the nitrogen test?

E. What other factors could affect the ability of wheat to get nutrients from the soil? (other than level of nutrients in the soil)

University of Idaho
College of Agriculture
Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 453

Northern
Idaho
Fertilizer
Guide

Winter Wheat

R. E. McDole and R. L. Mahler

These fertilizer guidelines have been developed through research conducted by the University of Idaho and Washington State University and are based on relationships between soil test and yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus, the fertilizer guide assumes good management.

The suggested fertilizer rates will be accurate for your field provided: (1) the soil samples were properly taken and represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate.

Optimum production and economical returns from wheat are achieved when the crop is managed properly. Lack of adequate fertilization, poor stands and poor pest control are major contributors to low yield.

Nitrogen

The amount of nitrogen (N) fertilizer required on any field depends on:

1. The wheat variety chosen and its potential in your location. The N guidelines in this publication were developed over many years using several varieties. Modern varieties require high levels of available soil nutrients and superior management to achieve their high yield potential. New varieties such as 'Stephens,' 'Daws' and 'Hill 81' have very high yield potentials.
2. Potential yield or average yield obtained from the field in past years. Research has shown that 2.7 pounds available N per acre is needed to produce 1 bushel of wheat.
3. The amount of usable N in the soil profile. This includes mineralizable nitrogen (released from organic matter during the growing season) and inorganic nitrogen in the form of nitrate (NO_3) and ammonium (NH_4).
4. Total annual precipitation and other climatic factors.
5. Density of plant stand.

In areas of low precipitation (16 inches or less annually), soil moisture in the profile should be determined to adjust the N fertilizer rates. In these low moisture areas and in areas with shallow soils (2 to 3 feet maximum depth), the recommended N fertilizer rate should be adjusted to fit available soil moisture.

Total N Needed Based On Potential Yield

Estimates of N fertilizer needed to produce a crop of winter wheat require knowledge of the potential yield for the field for which the fertilizer recommendation is being made. This potential yield should be the long-term average for the selected field. Based on the potential yield, the amount of N needed can be calculated using the factor 2.7 pounds N per bushel of wheat (Table 1). This factor has been derived through research conducted in northern Idaho and eastern Washington.

Table 1. Estimated total nitrogen needed by wheat crop based on potential yield.

bu/acre*	40	60	80	100	120	140
lb/acre N**	110	160	220	270	320	375

*Potential maximum yield of wheat produced on a northern Idaho farm for which fertilizer recommendation is being made.

**Research has shown that 2.7 pounds N per acre is needed to produce 1 bushel of wheat.

8. Use caution in topdressing with N in the spring since N applied after the boot stage or at excessive rates can result in undesirably high-protein levels in soft white wheats. Excessive rates also increase the lodging hazard.

9. Banding fertilizer improves N and P use efficiency. Consequently, if applying N and/or P in a band, cut the recommended fertilizer application rate 10 to 15 percent.

If you have questions regarding the interpretation of this information, contact your Extension county agricultural agent or your fertilizer dealer.

About the Authors — Robert D. McDole is an Extension soil specialist, and Robert L. Mahler is a research soil scientist, both in the University of Idaho Department of Plant, Soil and Entomological Sciences, Moscow.

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, H.R. Guenthner, Director of Cooperative Extension Service, University of Idaho, Moscow, Idaho 83843. We offer our programs and facilities to all people without regard to race, creed, color, sex or national origin.

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35 cents per copy

SMALL GRAIN PRODUCTION
UNIT 17

ANSWERS TO ASSIGNMENT SHEETS

Assignment sheet #1

Part I

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				
166	0	0	0	0	—	0	0	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

Part II

A. 2.7

B. Nitrogen released from organic matter during the growing season; 40 pound mineralizable nitrogen

C.

Total nitrogen needed	270
Minus mineralizable nitrogen	40
Minus soil test nitrogen (lb/acre)	64
Nitrogen fertilizer required (lb/acre)	166

D. 36 inches

E. Evaluated to satisfaction of instructor

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SMALL GRAIN PRODUCTION
UNIT 17

TEST

NAME____ SCORE______________

1. Match terms associated with small grain production to the correct definitions. Write the correct numbers in the blanks.

    1. Cool-season crop
    2. Vernalization
    3. Long-day plant
    4. Coleoptile
    5. Crop residue
    6. Erosion
    7. Stubble mulching
    8. Strip cropping
    9. Contour cropping
    10. No-till
    11. Minimum tillage

_____a. Planting and cultivating parallel with the lay of the land to prevent erosion

_____b. Sheath which covers the first leaf of grass seedlings during emergence

_____c. Cold treatment of a plant, plant part, or seed to initiate reproduction

_____d. Tillage beneath stubble without covering all of the residue

_____e. Any practice which reduces the number of tillage operations on a field

_____f. Plant material which is left on or in ground after harvest

_____g. Makes best growth under relatively cool conditions; are generally damaged by hot weather; includes wheat, barley, and oats

_____h. System of reduced tillage where cultivation and seeding are accomplished at the same time

_____i. Requires relatively short nights for the formation of flowers; short days increase vegetative growth

_____j. Alternate strips of crop and summer fallow to reduce erosion and conserve moisture

_____k. Removal of topsoil by tillage, wind, and/or water

TEST

2. List three uses of small grains.

   a.____

   b.____

   c.____

3. Select from the following list leading wheat producing states. Write an "X" in the blank before each correct answer.

   _____a. Idaho

   _____b. Montana

   _____c. Washington

   _____d. North Dakota

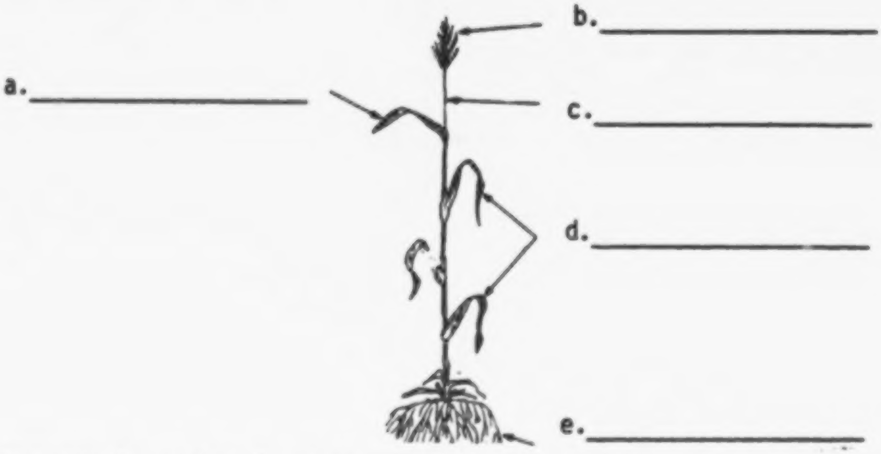
   _____e. Kansas

   _____f. Oklahoma

4. Discuss the economic importance of small grain production to Idaho.

TEST

5. Identify the parts of a wheat plant. Write the correct names in the blanks.



6. Arrange in order the stages of growth of small grains. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Flowering

_____b. Jointing

_____c. Seedling

_____d. Milk

_____e. Soft dough

_____f. Germination

_____g. Heading

_____h. Hard dough

_____i. Stooling

_____j. Boot

_____k. Mature

7. Select from the following list characteristics of a dersirable seedbed. Write an "X" in the blank before each correct answer.

_____a. Reasonably level

_____b. Availability of moisture adequate

_____c. Free of large clods for low erosion situation

_____d. Moderate amount of larger size clods for high erosion potential

_____e. Minimum of weed competition

_____f. Growing season of 210 to 240 days

TEST

8. List three tillage operations involved in seedbed preparation.

   a.____

   b.____

   c.____

9. Name two types of grain drills.

   a.____

   b.____

10. List two classes of wheat and what they are used for.

   a.____

   b.____

11. List two common varieties of seed for soft white spring wheat and soft white winter wheat.

   A. Soft white spring wheat

      1.____________________________________

      2.____________________________________

   B. Soft white winter wheat

      1.____________________________________

      2.____________________________________

12. Select from the following list factors to consider in planting small grains. Write an "X" in the blank before each correct answer.

   _____a. Time of planting

   _____b. Price of nitrogen fertilizer

   _____c. Cost of certified seed

   _____d. Seeding depth

   _____e. Rowspacing

   _____f. Seeding rates

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13. Select from the following list factors that influence final plant populations. Write an "X" in the blank before each correct answer.

_____a. Adequate soil moisture

_____b. Insect and disease damage

_____c. Seedling vigor

_____d. Planting rate

_____e. Planting depth

_____f. Availability of plant nutrients

_____g. Competition from weeds

_____h. Germination percentage

14. Using the information provided on the soil test report for R. I. Dunn, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide in making recommendations. Show all work.

SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No.________
Fee: $________
Paid: Cash____ Check____ Other____

Name R. I. Dunn
Address Latah County

County. Latah, eroded soil
Date ________
Sample Ident.________
Soil Texture________
Acres Sampled________
Sample Taken by________ (grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield-	Irrigation (sprinkler, furrow, none)
Next crop	Winter Wheat		Pot. 100 bu.	
Previous crop	Peas	residue returned		
Grown in 19____				
Grown in 19____				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth Cultivation or 0-7	(inches) Other
Soil Reaction - pH	6.5	
Available P (ppm P)	2.0	
Available K (ppm K)	125	
Soil Organic Matter, %	3.8	

NaHCO 1:20 NaOAc 1:5

B. Nitrogen Test

Soil depth (inches)	Nitrate ☒ nitrogen ppm N	Ammonium ☒ nitrogen ppm N	Available ☐ moisture (inches)
0-12	8	3	
12-24	2	1	
24-36	1	1	
36-48			
48-60			
60-72			
Total			

C. Cation Content ☐ Sample depth 12"

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

☐ Zinc ppm	☐ Manganese ppm	☐ Boron ppm	☒ Sulfate sulfur ppm	☐ Total Salts mmhos	☐ Gypsum Req. alkali soils	☐ Lime Req. acid soils	☐ Other
			6.0				

TEST

15. Name two small grain diseases.

a. ______________________________

b. ______________________________

16. Name one harmful insect of small grains.

a. ______________________________

17. Discuss how weeds compete with small grains.

____

____

____

____

____

____

____

____

____

18. List three ways weeds cause losses in small grain production.

a. ______________________________

b. ______________________________

c. ______________________________

19. Match the general categories of weeds to the correct description. Write the correct numbers in the blanks.

1. Annual
2. Perennial
3. Broadleaf
4. Grass

_____a. Live for three or more years and can reproduce sexually or asexually by means of rhizomes and stolons

_____b. Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots

_____c. Plants with longer, narrower leaves with parallel veination; monocots

_____d. Complete life cycle within the period of one year

TEST

20. Name three methods of weed control.

a. ______________________________

b. ______________________________

c. ______________________________

21. Select from the following list herbicides used to control weeds in small grains. Write an "X" in the blank before each correct answer.

_____a. 2,4-D

_____b. Roundup

_____c. Banvel

_____d. Far-go

_____e. Malathion

_____f. 2,4,5-T

22. Discuss approved practices for harvesting and storing small grains.

____

____

____

____

____

____

____

____

____

23. List three qualities of a good storage facility for small grains.

a. ______________________________

b. ______________________________

c. ______________________________

TEST

24. Match the types of grain markets to the correct description. Write the correct numbers in the blanks.

    1. Cash market
    2. Futures market

_____a. Operates in same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold

_____b. Contracting to purchase or deliver a certain amount of grain on a given date at a given price

25. List two main factors in grading grain.

a. ______________________________

b. ______________________________

SMALL GRAIN PRODUCTION
UNIT 17

ANSWERS TO TEST

1. a. 9
   b. 4
   c. 2
   d. 7
   e. 11
   f. 5
   g. 1
   h. 10
   i. 3
   j. 8
   k. 6

2. Answer should include any three of the following

   a. Baking flour
   b. Livestock feed
   c. Breakfast cereal
   d. Hay
   e. Pasture
   f. Protein supplements
   g. Glue products
   h. Bedding
   i. Malt

3. b, c, d, e, f

4. Evaluated to satisfaction of instructor

5. a. Head or flower
   b. Flag leaf
   c. Leaves
   d. Stem
   e. Roots

6. a. 7
   b. 4
   c. 2
   d. 8
   e. 9
   f. 1
   g. 6
   h. 10
   i. 3
   j. 5
   k. 11

7. a, b, c, d, e

8. Evaluated to satisfaction of instructor

9. a. End-wheel
   b. Press-wheel drill

10. Answer should include any two of the following

    a. Hard red spring wheat--Bread flour
    b. Hard red winter wheat--Bread flour
    c. Soft white wheat--Flour for pastries
    d. Soft red wheat--Flour for pastries
    e. Durum wheat--Noodles and similar products

11. A. Answer should include any two of the following

    1. Fielder
    2. Twin

    B. Answer should include any two of the following

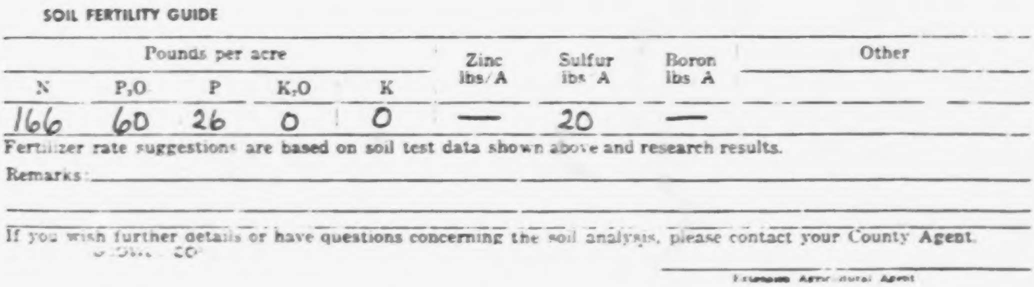
    1. Daws
    2. Nugaines
    3. Stephens

ANSWERS TO TEST

12. a, d, e, f

13. a, b, c, d, e, f, g, h

14.



SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs A	Boron lbs A	Other
N	P_2O_5	P	K_2O	K				
166	60	26	0	0	—	20	—	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

15. Answer should include any two of the following

a. Leaf rust b. Stem rust c. Powdery mildew

16. Green bug

17. Evaluated to satisfaction of instructor

18. a. Decreased yields
    b. Decreased crop quality
    c. Cost of control activities

19. a. 2 c. 4
    b. 3 d. 1

20. a. Cultural b. Mechanical c. Chemical

21. a, b, c, d

22. Evaluated to satisfaction of instructor

23. a. Weather-proof
    b. Rodent-proof
    c. Constructed of easy-to-clean material

24. a. 1 b. 2

25. Answer should include any two of the following

    a. Minimum weight per bushel
    b. Maximum percentage of damaged kernels
    c. Maximum percentage of foreign matter

CORN PRODUCTION
UNIT 18

UNIT OBJECTIVE

After completing this unit, the student should be able to describe corn production techniques involved in seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be shown by completing the unit test with a minimum score of 85 percent

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with corn production to the correct definitions.
2. List three uses of corn.
3. Select from a list leading corn producing states.
4. Select from a list true corn facts.
5. Discuss the economic importance of corn production to Idaho.
6. Name three types of corn.
7. Identify the parts of a corn plant.
8. Arrange in order the stages of growth of the corn plant.
9. List three purposes for which corn is grown in Idaho.
10. Select from a list advantages of using hybrid corn.
11. List three tillage operations involved in seedbed preparation.
12. Select from a list characteristics of a desirable seedbed.
13. Select from a list factors to consider in planting corn.
14. List three factors that influence rate of planting.
15. Select from a list factors that influence final plant populations.
16. Calculate fertilizer requirements for corn.
17. Name two corn diseases.
18. Name two harmful insects of corn.

OBJECTIVE SHEET

19. Discuss how weeds compete with corn.

20. List three ways weeds cause losses in corn production.

21. Match three general categories of weeds to the correct description.

22. Name three methods of weed control.

23. Select from a list herbicides used to control weeds in corn.

24. List three characteristics of high quality silage.

25. Select from a list factors to consider in harvesting high quality silage.

26. Discuss the harvesting and storing of grain corn.

27. Match the types of corn markets to the correct description.

CORN PRODUCTION
UNIT 18

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. Silage, instructional unit available from: Agri-Farm Publications, Inc., 1019 Market St., Gowrie, IA, 50543; approximate cost: $10.90, order no. 207.

      b. Corn, instructional unit available from: Agri-Farm Publications, Inc., 1019 Market St., Gowrie, IA, 50543; approximate cost: $19.75, order no. 201.

    2. Filmstrips, slideshows, etc.

      a. Corn Production, 10 cassettes, 10 filmstrips and study guide, available from: Teaching Aids, Inc. P. O. Box 1798, Costa Mesa, CA, 92626; approximate cost $359.00, order no. B262.

      b. Feeding and Handling High Moisture Corn, 46-frame filmstrip with script, available from: IAVIM, 208 Davidson Hall, Iowa State University, AMes, IA, 50011; approximate cost $6.50, order no. 327.

      c. Growing Corn and Beans No-Till in Crop Residues, 130-frame filmstrip with script, available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $16.50, order no. 333.

      d. Growing Corn No-Till in Sod, 97-frame filmstrip with cassette and script, available from: IAVIM, 208 Davidson Hall, Iowa State University, Ames, IA, 50011; approximate cost $12.50, order no. 334.

      e. Corn Production, 10 filmstrips, 10 cassettes, 18-22 minutes each and study guide, available from Agrimedia Corporation, Garden City, New York, 11530, approximate cost $257.00, order no. 262.

    3. Films

SUGGESTED ACTIVITIES

B. Make transparencies

C. Provide students with objective sheet

D. Provide students with information and assignment sheets

E. Discuss unit and specific objectives

F. Discuss information and assignment sheets

G. Do a community survey on corn production and publish the results in a local newspaper

H. Calibrate a corn planter as a class project

I. Invite local corn specialist to speak on corn production

J. Arrange for a field trip to corn processing plant

K. Arrange for a field trip to local grain elevator to discuss storage and marketing of corn

L. Make arrangements with seed company for class to visit local test plots and variety trials

M. Give test

N. Reteach if necessary

O. Retest

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Uses of corn

2. TM 2--World corn production

3. TM 3--Corn harvested for all purposes

4. TM 4--Leading corn producing states

SUGGESTED ACTIVITIES

5. TM 5--Parts of a corn plant
6. TM 6--Corn germination and seedling growth
7. TM 7--Vegetative growth stages of corn
8. TM 8--Development of an ear of corn

E. Assignment sheets

1. AS 1--Make fertilizer recommendations for field corn
2. AS 2--Make fertilizer recommendations for sweet corn

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Delorit. R.J., et al. Crop Production, 4th edition. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

B. Ensign, R.D., et al. Idaho Forage Crop Handbook. University of Idaho Current Information Series no. 547. Moscow, ID: 1975.

C. 1983 Corn Annual. Corn Refiners Association, Inc. Washington, D.C.

D. 1984 Corn Annual. Corn Refiners Association, Inc. Washington, D.C.

E. Painter, C.G., et al. Idaho Fertilizer Guide - Irrigated Field Corn for Silage or Grain. University of Idaho CIS no. 372 and 376. Moscow, ID: 1978.

F. Aldrich, S.R., et al. Modern Corn Production, 2nd edition. A & L Publications. Champaign, Illinois: 1982.

CORN PRODUCTION
UNIT 18

INFORMATION SHEET

I. Terms and definitions

   A. Forage--Vegetative material in a fresh, dried, or ensiled state which is fed to livestock

   B. Grain--The seed of cereal or grain crops such as corn, wheat, barley and oats

   C. Ensile--A process wherein fresh or slightly wilted forage is placed in air-tight storage and allowed to ferment and produce acids which then preserve it

   D. Silage--Forage chopped and stored at 60 to 70 percent moisture and allowed to ferment and produce acids which then preserve it

   E. Hybrid--The offspring of two parents which differ in one or more heritable characters

   F. Tassel--The flower on the upper portion of the stem of corn; it contains the stamens

   G. Lodging--A condition that occurs when the stems are not strong enough to hold the plants erect and they bend or break over

   H. Stover--The mature stalks of corn from which the grain has been removed

   I. Fodder--The entire plant of grasses, such as corn (including the grain), which is harvested, cured, and fed

   J. Cultivation--Tillage to control weeds

   K. Competition--Process whereby individuals or groups directly inhibit the growth of others by utilizing resources potentially available to all

II. Uses of corn (Transparency #1)

   A. Livestock feed

   (Note: Most corn grown in the U.S. is fed to livestock.)

INFORMATION SHEET

B. Products for human consumption

   1. Corn meal

   2. Corn hominy

   3. Corn flakes

C. Industrial products

   1. Alcohol

   2. Corn starch

   3. Corn oil

III. Leading corn producing states (Transparencies #2, #3, and #4)

(Note: Corn is the most valuable crop grown in the U.S. Its production and value are greater than that of wheat, barley, oats, rye, rice, and buckwheat. About one-half of the world's corn crop is grown in an area of the midwestern U.S. called the corn belt. During the last ten years, Iowa and Illinois produced from 37 to 43 percent of the nation's total production.)

A. Iowa

B. Illinois

C. Nebraska

D. Minnesota

E. Indiana

F. Ohio

IV. Corn facts

A. Corn can be grown in every state except Alaska

B. Corn ranks second to wheat in acreage among field crops in the world

C. The United States exports 48,300,000 metric tons of corn annually, which accounts for 77% of world corn exports

D. U.S. produces 31% of world crop

E. Corn is represented in the FFA emblem and stands for common agricultural interest because it is grown in every state

INFORMATION SHEET

V. Economic importance of corn production to Idaho (1984)

   A. Field corn harvested for grain

      1. 59,000 acres harvested

      2. 119 bushels grain yield per harvested acre

      3. 7,021,000 bushels total production

      4. Economic value to the state of $17,588,000

   B. Field corn harvested for silage

      1. 84,000 acres harvested

      2. 21.0 tons silage per harvested acre

      3. 1,764,000 tons total production

VI. Types of corn

   A. Dent

   (Note: About 95% of all corn grown in the U.S. is dent corn. This type is characterized by denting of the crowns of the kernels as the grain ripens.)

   B. Sweet

   C. Popcorn

   D. Flour corn

   E. Waxy corn

VII. Parts of a corn plant (Transparency #5)

   A. Tassel

   B. Ear

   C. Stem

   D. Leaves

   E. Roots

INFORMATION SHEET

VIII. Stages of growth of the corn plant (Transparencies #6, #7, and #8)

(Note: The corn plant is one of nature's most amazing energy-storing devices. From a seed that weighs little more than one-hundreth of an ounce, a plant 7 to 10 feet tall develops in about nine weeks. In the following two months, this plant produces 600 to 1,000 seeds similar to the one from which it started. For perspective, the corn plant's achievement can be compared with that of small grains: wheat produces a 50-fold yield per seed planted.)

A. Two-leaf stage--Occurs about two weeks after the first leaf emerges above the soil surface

(Note: Until this time, the plant has been dependent for nourishment on the food stored in the endosperm of the seed. At the two-leaf stage, the young plant is nearly ready to function independently. The plant growth processes of photosynthesis, respiration, transpiration, and absorption need to function for growth to occur.)

B. Six-leaf stage

(Note: From the two-leaf stage until the six-leaf stage, root and leaf development takes place at a rapid rate. Root hairs develop, and the absorption of moisture and nutrients increase as the plant grows. Secondary roots are developing rapidly.)

C. Ten-leaf stage--The tenth leaf should be fully emerged in a period of five weeks from plant emergence

(Note: During the ten-leaf stage nutrient needs increase. Photosynthesis and absorption must function efficiently for suitable growth of both leaves and roots.)

D. Fourteen-leaf stage

(Note: In the fourteen-leaf stage the unseen tassel and the stalk are developing rapidly. Dry weight of the plant has increased rapidly. Any nutrient or moisture deficiencies can seriously reduce the number of kernels that will develop on the ears. For optimal growth, the plant processes of photosynthesis, respiration and absorption must function very efficiently from this stage until the ear has completely developed.)

INFORMATION SHEET

E. Tassel emergence

(Note: When a corn plant is about eight weeks old, the tip of the tassel can be seen emerging from the leaf whorls at the top of the plant. The tassel started to develop below ground when the plant was four weeks old. At nine weeks the very small ear shoot can be seen.)

F. Pollination and fertilization

(Note: When the corn plant is about nine-and-a-half weeks of age, the tassel has fully emerged and is starting to shed pollen. After a pollen grain alights on the silk of a corn plant, a pollen tube grows toward the ovary.)

G. Blister-stage

(Note: At about eleven weeks pollination is complete. Silks have started to turn brown. The kernels are somewhat round and not yet fully formed.)

H. Dough Stage (roasting ear stage)

(Note: At about thirteen weeks, the kernels are full of moisture and taking shape. Growth is rapid and starch is accumulating in the endosperm.)

I. Dent stage

(Note: At 15 weeks, kernels are dented and almost fully developed.)

J. Mature stage

(Note: At 17 weeks, the ear development is complete. Most of the husk and leaf blades have started to die. Moisture is at 35 percent. The ear is considered mature.)

IX. Purposes for which corn is grown in Idaho

A. Field corn for grain

1. DX 1096--6.67 Ton/Acre (Dairyland's)

2. G 4342--6.672 Ton/Acre (Funks)

3. SS 70--6.61 Ton/Acre (Crookham)

INFORMATION SHEET

B. Field corn for silage

1. TXSH5A--62.4 Ton/Acre (DeKalb)

2. PAG5X 351--41.6 Ton/Acre (PAG)

3. KS 1150--41.2 Ton/Acre (Kelton)

C. Sweet corn for processing

1. Jubilee--7-9 Ton/Acre (Roger Bros.)

2. Dominator--5-9 Ton/Acre (Roger Bros.)

3. Style Pak--6-9 Ton/Acre (Ferry Morse)

X. Advantages of using hybrid corn

A. Produces better quality grain and forage

B. Better uniformity of growth and maturity

C. Produces higher yields

D. Greater resistance to diseases and certain insects

E. More resistant to lodging

F. Withstand drought better

(Note: In 1933 only 0.1% of the corn acreage in the U.S. was planted with hybrid seed. In 1960 95.9% of all corn grown was hybrid.)

XI. Tillage operations involved in seedbed preparation

A. Primary tillage

1. Moldboard plow

a. Time--Spring or fall

b. Depth--Nine inches

c. Moisture needed

2. Ripper (chisel plow)

a. Time--Fall

b. Depth--Twelve to fourteen inches

c. Dry conditions needed

INFORMATION SHEET

B. Secondary Tillage

1. Disk

a. Time--Spring

b. Depth--Three to six inches

2. Harrow

a. Time--Spring

b. Depth--Three to four inches

3. Roller

a. Time--Spring

b. Depth--Surface

4. Field cultivator

a. Time--One to two weeks following emergence, and as necessary to control weeds until corn is too high for cultivation

b. Depth--1 inch

XII. Characteristics of a desirable seedbed

A. Fine enough to give good contact between seed and soil

B. Loose enough for good air circulation

C. Warm

D. Adequate available moisture

E. Minimum of weeds

XIII. Factors to consider in planting corn

A. Plant early

(Note: Earlier than normal planting is the single best opportunity for most good corn growers to further increase yields. Planting dates range from April 5 to June 18.)

INFORMATION SHEET

B. Plant when soil temperature has reached 60 F

(Note: Most types of corn will not germinate or it is very slow at temperatures less than 60 F. The longer germination takes the more susceptible the seed and seedling will be to soil-borne diseases. By the time the soil has warmed up to 60 F, germination is prompt and the seedling will be above ground in 7 to 10 days after planting.)

C. Seeding depth

1. Early plantings--1 1/2 - 2 inches

2. Later plantings--2 - 3 inches

(Note: The two factors which most influence seeding depth are soil temperature and level of moisture in the soil.)

D. Seeding rates--One seed every 8 inches in row; approximate plant population of 18,000-21,000 plants per acre

E. Rowspacing--Thirty inches

(Note: Rowspacing should correspond with harvesting equipment you will be using.)

XIV. Factors that influence rate of planting

A. Time of planting

(Note: When planting extra early, you can plant 2,000 to 3,000 more kernels per acre because seedling mortality is a little greater.)

B. Fertility of the soil

C. Available supply of moisture

(Note: This is not a factor if adequate irrigation water is available.)

D. Variety

E. Purpose for which crop is grown

INFORMATION SHEET

XV. Factors which influence final plant populations

A. Time of planting

B. Planting rate

C. Planting depth

D. Germination percentage

E. Vigor of seedling

F. Availability of plant nutrients

G. Moisture available in adequate amounts

H. Competition from weeds

I. Damage from disease and insects

XVI. Fertilizer requirement

A. Soil testing

(Note: Use soil test results in conjunction with University of Idaho Fertilizer Guides - CIS #372 and #376. Nutrients of concern for soil test include nitrogen, phosphorus, potassium, sulphur, and zinc. Applications of other nutrients have not been shown to be responsive or economical and are not suggested. Consult your local county extension agent or field man for more help in calculating fertilizer requirements.)

XVII. Corn diseases

A. Corn smut

1. Symptoms--Grayish-white galls that are filled with black spores on tassel, ear, as well as all other above-ground parts of the corn plant

2. Causal agent--Fungus

3. Control--Rotation of crops, clean plowing and cutting and destroying infected stalks; application of fresh barnyard manure will increase occurence

B. Northern leaf blight

1. Symptoms--Small grayish-green spots on leaves which later turn dark tan; the lesions enlarge and develop a characteristic spindle shape

INFORMATION SHEET

2. Causal agent--Fungus

3. Control--Use resistant varieties; plants grown in soils high in potassium suffer less from the disease

XVIII. Insects affecting corn production

A. Western corn rootworm

1. Description--Beetle about 1/4 inch long, slender, yellowish-green with three dark stripes or a dark area formed by the merger of these stripes on the back

2. Damage--The larvae feed on root hairs and tunnel into corn roots for about a month before they are full grown; this feeding may stunt the plant and reduce yields; damaged plants may lodge, increasing harvesting costs

3. Control

a. Crop rotation

b. Chemical control

1) Adults--Foliar application of malathion, sevin, Di-syston or others

2) Larvae--Soil treatment using Furadan, Di-Syston, Diazinon and others

(Note: Refer to University of Idaho CIS #533, The Western Corn Rootworm for further information on chemical control of this pest.)

B. Corn earworm

1. Description--Moths are attracted to silking corn and deposit eggs on the silks; the eggs hatch producing caterpillars which infest corn from silking to maturity

2. Damage--Caterpillars infest and feed on ears

3. Control--Chemical control of larvae on the silk before the worms enter the ears

C. Western bean cutworm

1. Description--Adult is millermoth with brown wings with light tan shading on the outer margin; the larvae are creamy white to light gray with a black head, and turn tan color when mature; the segment behind the head has three longitudinal white stripes

INFORMATION SHEET

2. Damage--Newly hatched larvae feed on leaves and in the emerging tassel; larger worms tunnel into ears at any point and feed on kernels, lowering yields and quality

3. Control--Chemical control

   (Note: Refer to University of Idaho CIS #302, Western Bean Cutworm on beans and corn for further information on chemical control of this pest.)

XIX. How weeds compete with corn

A. Competition for water

B. Competition for plant nutrients

C. Competition for light

(Note: Corn and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XX. Losses caused by weeds

A. Decreased yield

B. Decreased crop quality

C. Cost of control activities

XXI. General categories of weeds

A. Annual--Complete life cycle within a period of one year

B. Perennial--Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

C. Broadleaf--Plant with shorter, wider leaves that usually have pinnate or netted veination; dicots

D. Grass--Plant with longer, narrower leaves with parallel veination; monocots

XXII. Methods of weed control

A. Cultural

B. Mechanical

C. Chemical

INFORMATION SHEET

XXIII. Control weeds in corn with herbicides

(Note: Before you use herbicides, read and understand the directions on the container label. Follow these directions carefully. Refer to University of Idaho Weed Control Handbook for further helpful hints.)

A. Weed problem--Annual grasses

   1. Sultan+

B. Weed problem--Annual broadleaf

   1. Banvel
   2. 2,4-D
   3. Basagran
   4. Brominal ME4

C. Weed problem--Annual broadleaf and grasses

   1. Atrazine
   2. Bladex
   3. Dual 8E
   4. Eradicane
   5. Lasso
   6. Ramrod
   7. Paraquat
   8. Premerge
   9. Karmex
   10. Evik

D. Weed problem--Perennials

   1. Dowpon M
   2. Roundup

INFORMATION SHEET

XXIV. Characteristics of high quality silage

A. High energy with plenty of grain, showing that it was cut late enought for near maximum yield

B. Good palatability from cutting at the right time and ensiling properly

C. Good keeping quality, no mold

D. Not enough nitrate to be a problem

XXV. Factors to consider in harvesting high quality silage

A. Harvest when moisture content of plant is 60 to 65 percent

(Note: To determine moisture content, take 5 pounds of chopped material and place in oven at 200 F for 2 to 3 hours, and then reweigh. Subtract the dry weight from the beginning weight, and multiply by 20 to get the percent moisture.)

B. Pack silage tightly in pit or silo

(Note: Silage must be packed tightly so that all the air will be used up so that molds cannot grow. The heat that develops during the first two days after corn is ensiled is caused by respiration of the still-living cells of the corn plant. About the third day, the growth of molds begins to contribute to the heating. If the silage is well packed, the air supply is soon exhausted, the mold stops growing and the heating ceases.)

C. Add water to bring silage to 65% moisture if necessary

(Note: When the corn crop is too dry for ideal silage because it was frosted or is too nearly ripe, it does not pack well and the air is not forced out. Mold begins to grow. Two things can be done to reduce the amount of air in the silage. First, chop finer to facilitate packing. Second, add water to soften corn leaves and stalks so they will pack better.)

D. Cover pit with air-proof material

XXVI. Harvesting and storing grain corn

A. A combine with a corn head is the most efficient harvester of corn

(Note: Lowest losses of all are for combine harvest and storage as high-moisture corn.)

B. Corn is mature when the grain has about 30 to 32 percent moisture; the best time to harvest depends on your harvest and storage system

(Note: Early harvesting of corn generally is best because you have less lodging from stalk rot, ear drop is less, and less grain is shelled when the ear hits the snapping rolls.)

C. For long-term storage, shelled corn should be down to 13 percent moisture

(Note: The drawback to early harvesting is that the grain must be dried to an acceptable level for storage.)

XXVII. Corn markets

A. Cash market--Operates in the same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold

(Note: If you grow corn for the market, you have to decide whether you can make more profit by selling direct from the field or by storing the crop for a while. The important factors are the cost of farm storage and your prediction on trends in corn prices after harvest.)

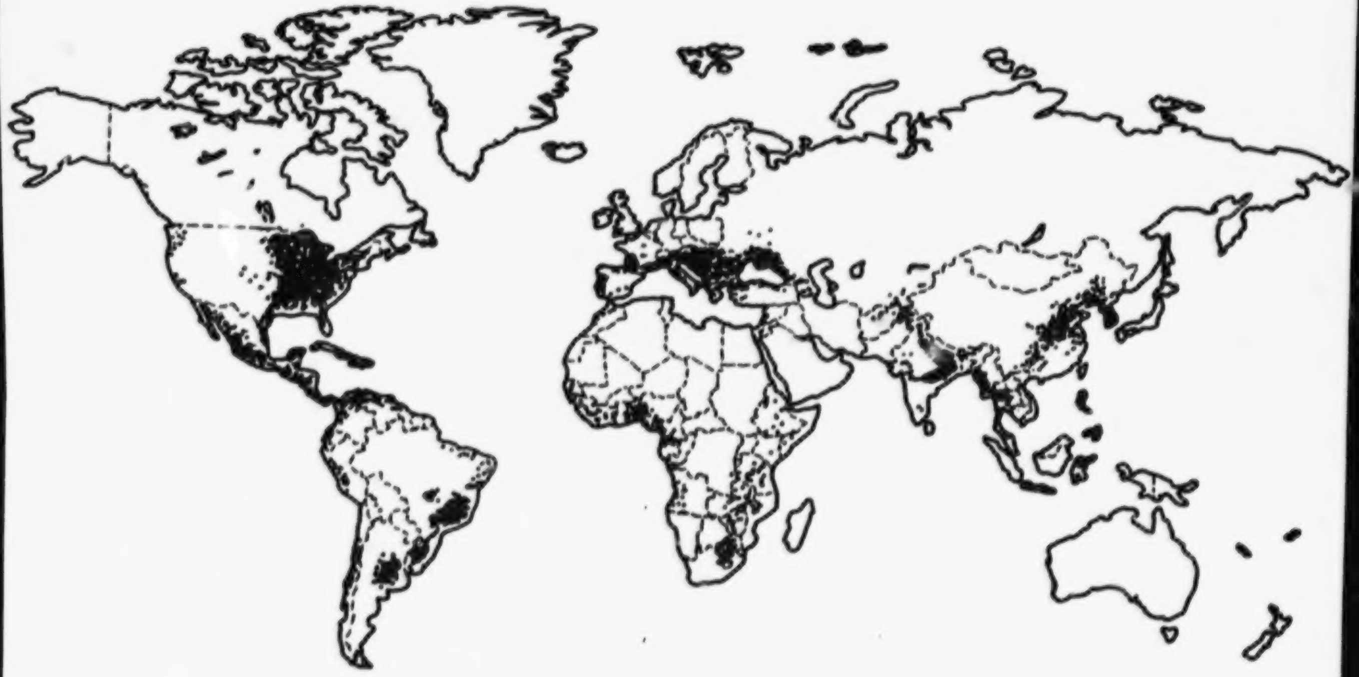
B. Futures market--Forward contracting to purchase or deliver a certain amount of grain on a given date at a given price

(Note: This ensures the producer a market for his grain and reduces the risk of declining market prices. This ensures the buyer of delivery of grain at a certain time and reduces the risk of rising market prices.)

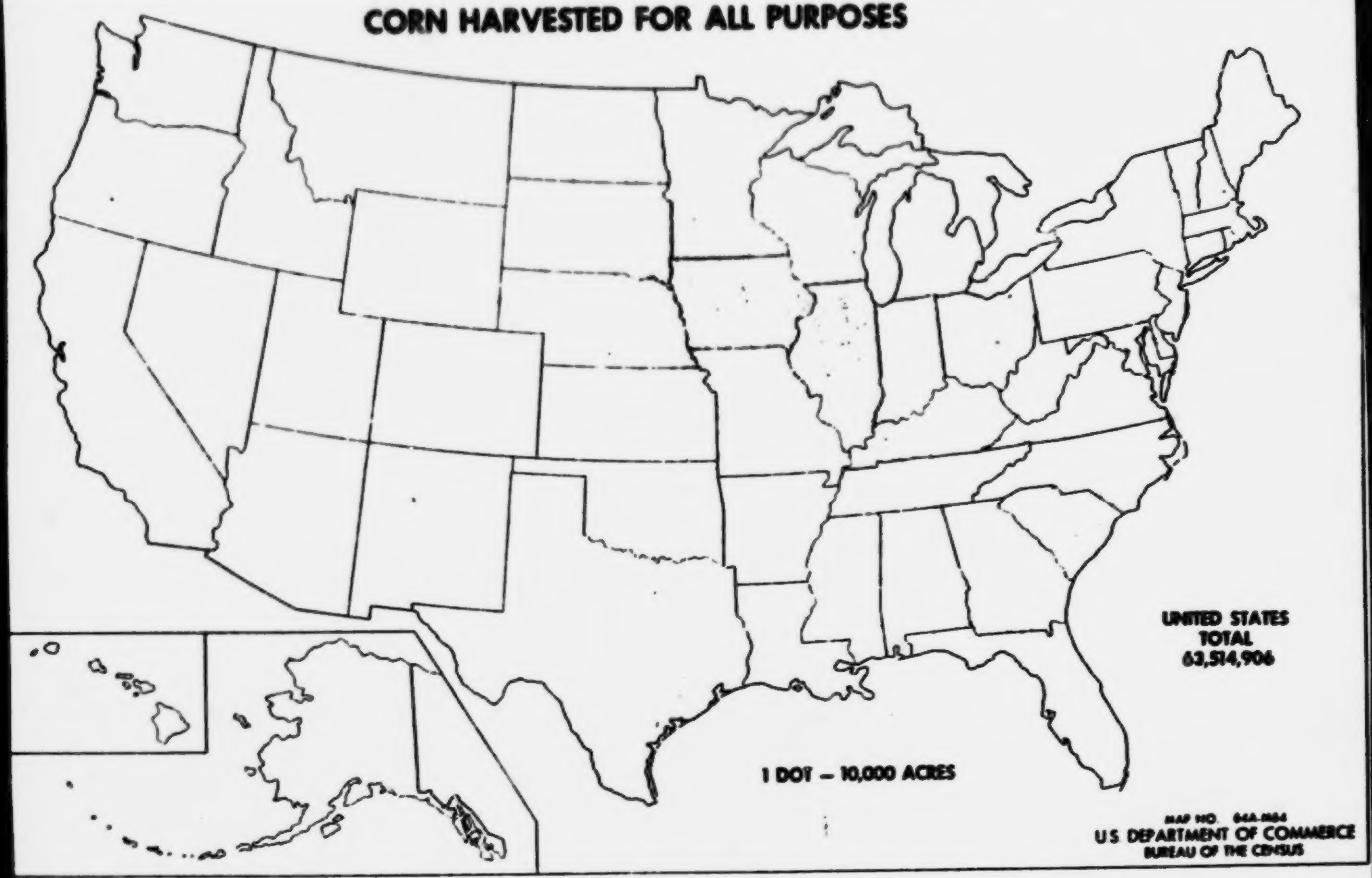
Uses of Corn

1. Livestock Feed
2. Products for Human Consumption
   - Corn Meal
   - Corn Hominy
   - Corn Flakes
3. Industrial Products
   - Alcohol
   - Corn Starch
   - Corn Oil

World Corn Production



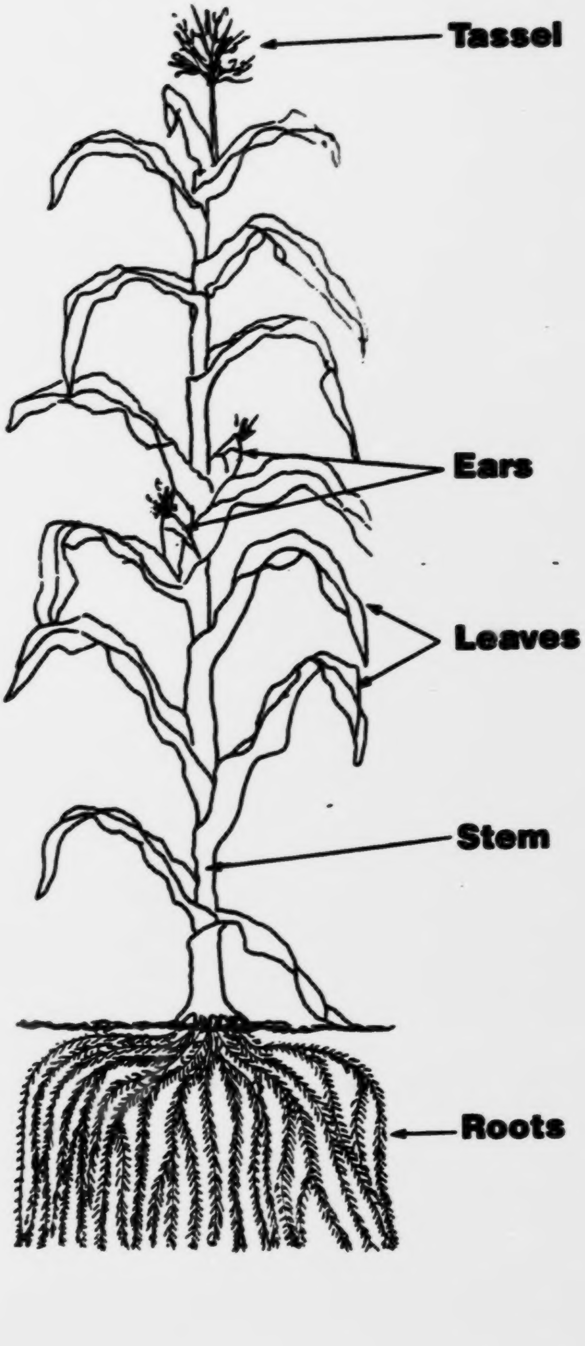
CORN HARVESTED FOR ALL PURPOSES


UNITED STATES
TOTAL
63,514,906
1 DOT – 10,000 ACRES
MAP NO. 64A-M84
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

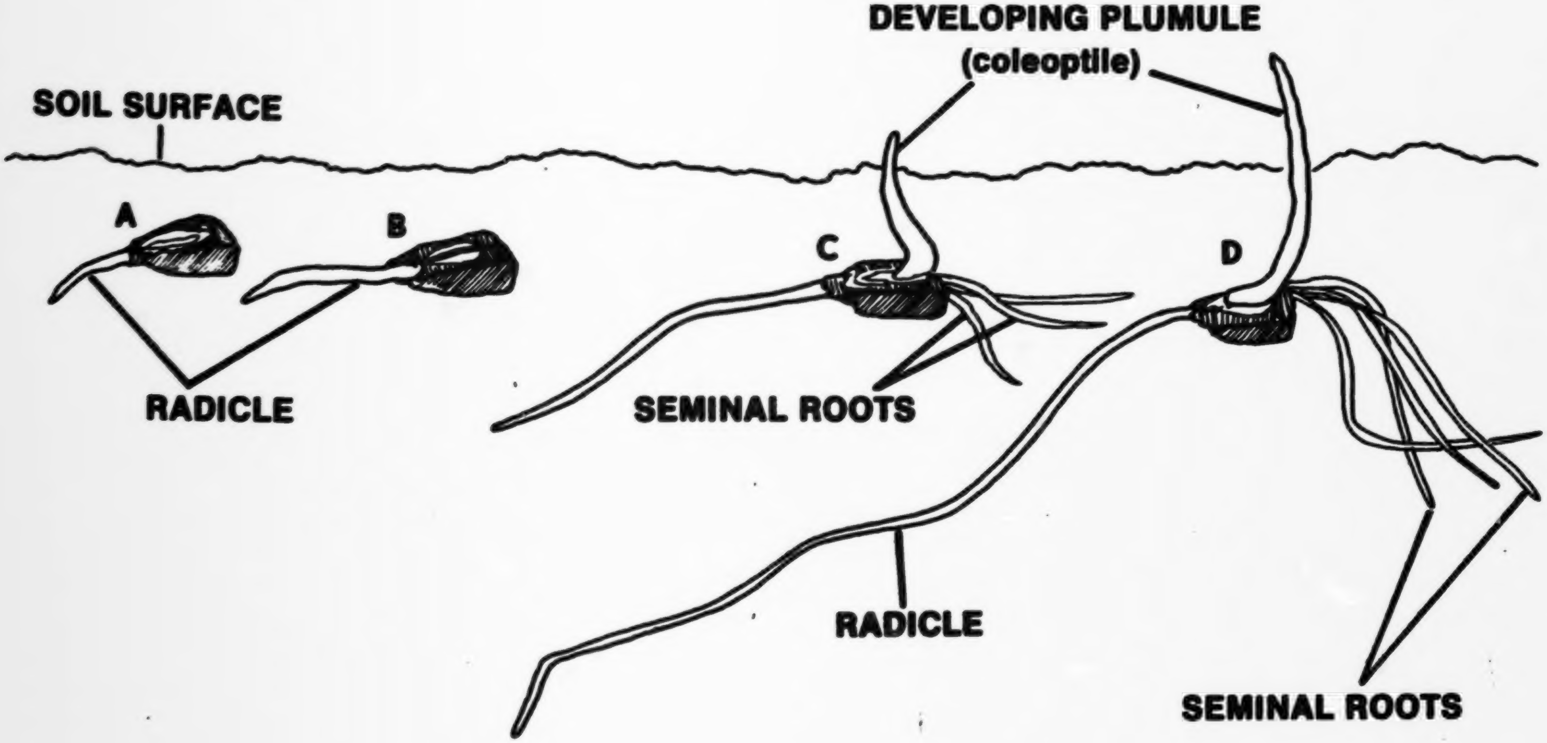
Leading Corn Producing States

1. Iowa
2. Illinois
3. Nebraska
4. Minnesota
5. Indiana
6. Ohio

Parts of a Corn Plant


Tassel
Ears
Leaves
Stem
Roots

CORN GERMINATION AND SEEDLING GROWTH


DEVELOPING PLUMULE
(coleoptile)
SOIL SURFACE
A
B
C
D
RADICLE
SEMINAL ROOTS
RADICLE
SEMINAL ROOTS

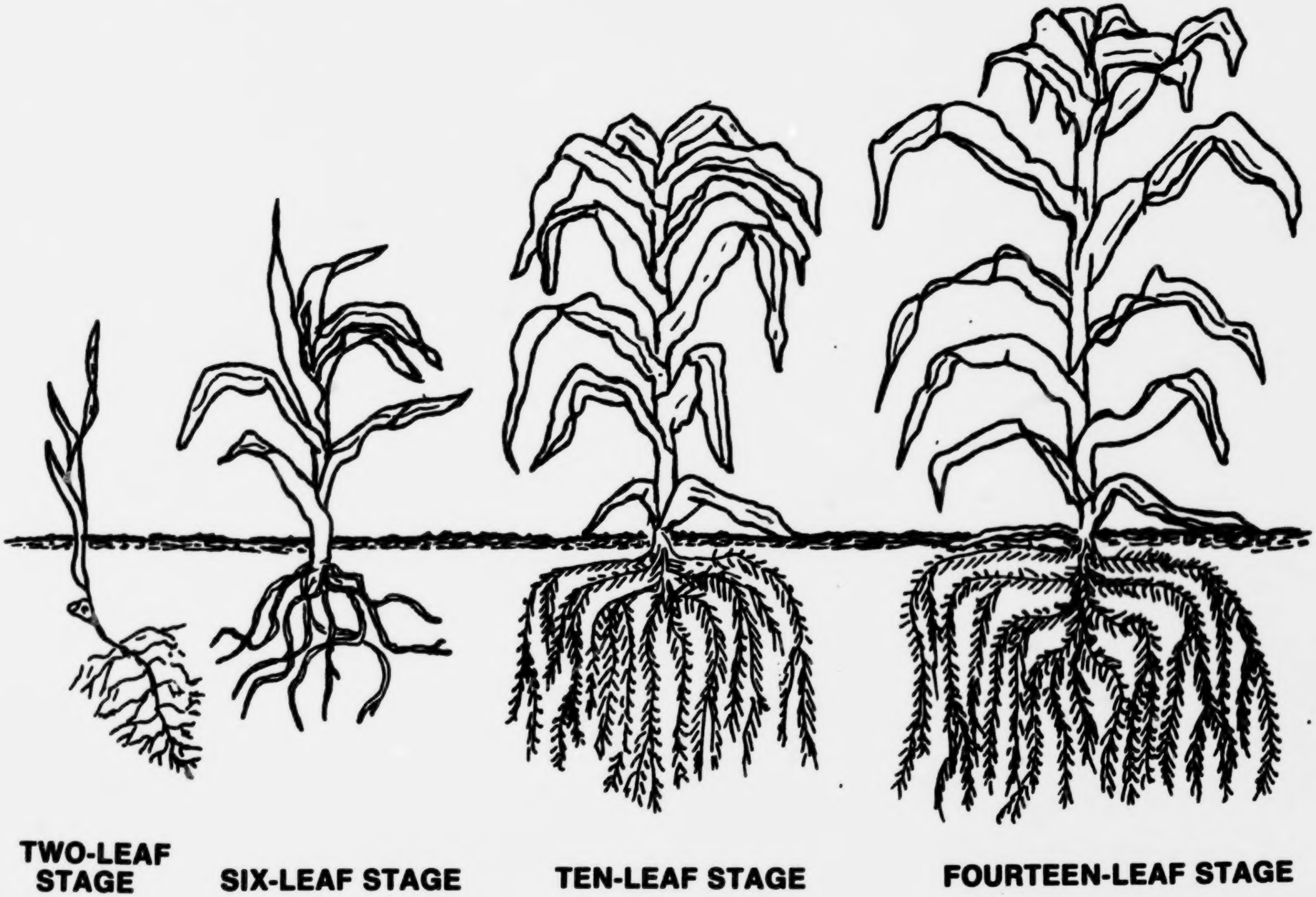
TM #6

685

The germination and seedling growth of a corn plant
(A and B) The radicle enlarges and starts to grow in the soil.
(C and D) The plumule and seminal root start to develop.

CSS 18 25

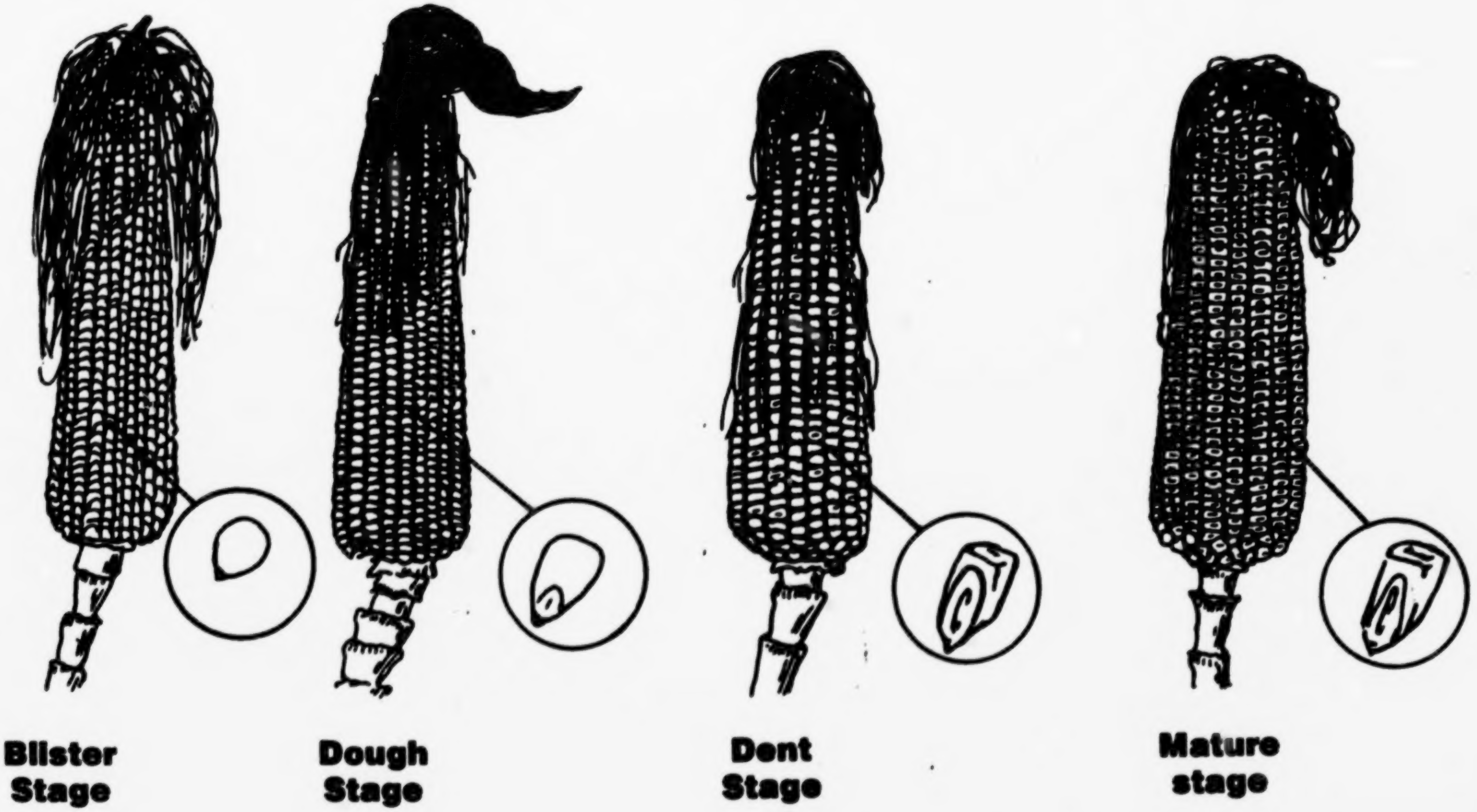
VEGETATIVE GROWTH STAGES OF CORN


TWO-LEAF STAGE
SIX-LEAF STAGE
TEN-LEAF STAGE
FOURTEEN-LEAF STAGE

TM #7

CSS 18 26

Development of an Ear of Corn


Blister Stage
Dough Stage
Dent Stage
Mature stage

TM #8

CSS 18 27

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CSS 18 28

CORN PRODUCTION
UNIT 18

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR FIELD CORN

NAME_______________________________ SCORE__________

Using the information provided on the soil test report for E. Z. Tymes, and University of Idaho CIS #372 - Idaho Fertilizer Guide for Irrigated Field Corn, recommend the amount of each nutrient that will need to be applied to achieve an average yield. Refer to the fertilizer guide for more complete directions.

PART I

SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No.________
Fee: $________
Paid: Cash____ Check____ Other____

Name E. Z. Tymes
Address Nampa, Idaho

County________
Date________
Sample Ident.________
Soil Texture________
Acres Sampled________
Sample Taken by________ (grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Field corn for grain			
Previous crop	wheat		80 bu/acre	
Grown in 19____			residue returned	
Grown in 19____				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth (inches) Cultivation or 0-7	Other
Soil Reaction - pH	6.8	
Available P (ppm P)	4.5	
Available K (ppm K)	79	
Soil Organic Matter, %	4.0	

NaHCO$_3$ 1:20 NaOAc 1:5

C. Cation Content ☐ Sample depth 12"

B. Nitrogen Test

Soil depth (inches)	Nitrate nitrogen ppm N ☒	Ammonium nitrogen ppm N ☒	Available moisture (inches) ☐
0-12	0	1	
12-24	2.5	2	
24-36			
36-48			
48-60			
60-72			
Total			

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

Zinc ppm ☒	Manganese ppm ☐	Boron ppm ☐	Sulfate sulfur ppm ☒	Total Salts mmhos ☐	Gypsum Req. alkali soils ☐	Lime Req. acid soils ☐	Other ☐
1.0			8				

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:________

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

GROWE: COP

____
Extension Agricultural Agent

ASSIGNMENT SHEET #1

PART II

A. Considering 20 bushel yield of wheat is equal to one ton of residue returned, answer the following questions:

   1. How many tons of wheat residue were returned to the soil?

   2. How much extra nitrogen will we need to apply to compensate for tie-up by the residue?

B. How deep should the soil sample be taken for the nitrogen test?

C. How deep should the soil test be for the remainder of the tests?

D. What other factors could affect the ability of field corn to get nutrients from the soil? (other than level of nutrients in the soil)

University of Idaho
College of Agriculture

Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 372

December 1978

Idaho Fertilizer Guide

Irrigated Field Corn for Silage or Grain

The following fertilizer guidelines are based on relationships established between University of Idaho soil tests and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus, the fertilizer guide assumes good management.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate.

NITROGEN (N)

Nitrogen rates depend upon some of the following factors: length of growing season, previous crop, past fertilizer use, soil type and leaching hazard and a realistic yield goal for the grower and the area (Table 1).

Nitrogen fertilizer can be applied preplant and incorporated. On sandy textured soils subject to leaching, sidedress a portion of the nitrogen at time of last cultivation.

Table 1. Nitrogen fertilizer rate based on previous crop

Previous crop	N application (lb. N/acre)		
	Western Idaho	Magic Valley	Eastern Idaho
Grain or corn (residue returned)	220	190	160
Grain or corn (residue removed)	180	150	120
Row crop	160	130	100
Beans, peas or alfalfa stubble	120	90	60
Green manure legumes	100	70	40

Nitrogen Soil Test

A nitrogen soil test can evaluate the carry-over from heavily fertilized row crops. Since nitrate nitrogen (NO_3N) is mobile, the soil samples should represent soil depths of 0 to 12 and 12 to 24 inches. Nitrogen soil test following alfalfa has limited value.

The soil test values in Table 2 represent the sum of the nitrate nitrogen and ammonium nitrogen (NH_4) in the top 2 feet of soil by 1 foot increments.

Table 2. Nitrogen fertilizer rate based on N soil test

Nitrogen soil test (0 - 24" depth) N (ppm)	N application* (lb. N/acre)
0	160
10	120
20	80
30	40
over 40	0

* Add 20 lb. N for each ton of grain straw or non-legume residue plowed under up to 60 lb. N/acre. Straw yields are normally 3 to 4 tons/acre

PHOSPHORUS (P)

Corn will respond to phosphorus fertilizer if soil levels are low. The soil test is based on available phosphorus present to the depth of plowing and the soil samples should represent this area. Phosphorus should be plowed down or banded in the seedbed. (Table 3.)

Table 3. Phosphorus fertilizer rate based on soil test.

Soil Test Inches soil depth		Apply lb./acre	
0-9	0-12		
Phosphorus (P) ppm*		P_2O_5	(P)**
0	0	240	106
4	3	160	70
8	6	80	35
over 12	over 10	0	0

* P test is by $NaHCO_3$ extraction.

** Phosphorus is expressed as both the oxide and elemental forms: $P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$.

POTASSIUM (K)

Corn has a medium requirement for available soil potassium (Table 4.)

Table 4. Potassium fertilizer rate based on soil test.

Soil Test Inches soil depth		Apply lb./acre	
0-9	0-12		
Potassium (K) ppm*		K_2O	(K)**
0	0	240	200
30	22	160	133
60	45	80	66
90	68	40	33
over 120	90	0	0

* K test is by $NaHCO_3$ extraction.

** Potassium is expressed as both the oxide and elemental forms: $K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$.

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MICRONUTRIENTS

Zinc (Zn) - While zinc deficiencies have not been widespread on corn, corn is sensitive to zinc deficiency particularly on leveled or exposed limey subsoil areas. When the soil test for zinc is less than 0.6 ppm in the 0- to 12-inch soil depth or when subsoils are exposed, apply zinc fertilizer to supply 10 pounds of zinc per acre or equivalent.

Other micronutrients have not been shown to be limiting corn production. "Shotgun" applications of micronutrient mixtures containing boron, manganese, iron and copper "for insurance" have not been shown to be responsive and are not suggested.

SULFUR (S)

The major corn growing regions of Idaho should not experience sulfur deficiency. Soils testing less than 8 ppm SO_4S in the 0- to 12-inch soil depth or areas known to be deficient in sulfur should receive 30 pounds sulfur per acre.

SALINITY (SALTS)

Corn has a low to moderate tolerance to salty soil. Soils over 3 or 4 mmhos/cm may be too salty for beans or potatoes but can be utilized for corn. Corn can be grown satisfactorily on soils up to about 6 mmhos/cm.

GENERAL COMMENTS

1. Narrow rows (32 inches or less), high plant population (average 28,000) and early plantings can utilize high rates of fertilizer. If plant populations or growing season are not adequate, high rates of fertilizer will not compensate.
2. Sidedressing may cause root pruning depending upon plant size, distance of shank from the row and depth.
3. Over-irrigation and nitrogen leaching are a hazard on all soils, particularly sandy-textured soils.
4. Irrigation, weed and disease control, variety and plant population will influence the effectiveness of your fertilizer applications.
5. Select a variety that matures approximately 10 days earlier than the average first-frost in the fall in your area.

If you have any questions regarding the interpretation of this information, please contact your County Extension Agent.

Prepared by Charles G. Painter in cooperation with Robert Higgins, J.P. Jones, H.R. Guenthner and Edward Owens, Department of Soil and Plant Sciences, University of Idaho College of Agriculture.

Issued in furtherance of cooperative Extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture, James L. Graves, Director of Cooperative Extension Service, University of Idaho, Moscow, Idaho 83843. We offer our programs and facilities to all people without regard to race, creed, color, sex or national origin.

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CORN PRODUCTION
UNIT 18

ASSIGNMENT SHEET #2--MAKE FERTILIZER RECOMMENDATIONS FOR SWEET CORN

NAME_______________________________ SCORE____________

Using the information provided on the soil test report for Blue Bonnett, and University of Idaho CIS #376 - Idaho Fertilizer Guide for Sweet Corn, recommend the amount of each nutrient that will need to be applied to achieve an average yield. Refer to the fertilizer guide for more complete directions.

PART I

SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No.____________

Fee: $____________

Paid: Cash____ Check____ Other____

Name Blue Bonnett

Address Caldwell, Idaho

County____________

Date____________

Sample Ident.____________

Soil Texture____________

Acres Sampled____________

Sample Taken by____________
(grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Sweet	Corn for	seed	
Previous crop	Onions			
Grown in 19___				
Grown in 19___				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth	(inches)
	Cultivation or 0-7	Other
Soil Reaction - pH	7.1	
Available P (ppm P)	2.5	
Available K (ppm K)	145	
Soil Organic Matter, %	4.0	

NaHCO₃ 1:20 NaOAc 1:5

C. Cation Content ☐ Sample depth 12"

B. Nitrogen Test

Soil depth (inches)	Nitrate ☒ nitrogen ppm N	Ammonium ☒ nitrogen ppm N	Available ☐ moisture (inches)
0-12	1.4	2	
12-24	2.6	9	
24-36			
36-48			
48-60			
60-72			
Total			

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

☒ Zinc ppm	☐ Manganese ppm	☐ Boron ppm	☒ Sulfate sulfur ppm	☐ Total Salts mmhos	☐ Gypsum Req. alkali soils	☐ Lime Req. acid soils	☐ Other
0.6			12				

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:______________________________

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

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Extension Agricultural Agent

ASSIGNMENT SHEET #2

PART II

A. What factors will affect the amount of nitrogen to be applied?

B. How and when should nitrogen fertilizer be applied to sweet corn? Why is side dressing discouraged?

C. What is the maximum anount of nitrogen that should be applied to compensate for nitrogen tie-up by incorporated crop residue?

D. What other factors could affect the ability of sweet corn to get nutrients from the soil? (other than level of nutrients in the soil)

University of Idaho
College of Agriculture

Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 376

Reprinted July 1980

Idaho Fertilizer Guide

Sweet Corn for Seed and Processing

The following fertilizer guidelines are based on relationships established between University of Idaho soil test and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus the fertilizer guide assumes use of good crop management practices.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate.

NITROGEN (N)

Nitrogen rates depend upon some of the following factors: previous crop, past fertilizer use, soil type and leaching hazard and a realistic yield goal for the grower and the area.

Nitrogen fertilizer should be applied pre-plant and incorporated into the soil. Late side dressing will encourage stalk rot which is more prevalent in seed than processed corn. If side dressing is necessary; for seed, apply no later than early emergence. For processing, apply at time of last cultivation. The ammonium (NH_4) source of nitrogen will increase stalk rot when compared with the nitrate (NO_3) source. Nitrogen rates suggested for optimum sweet corn production as influenced by previous crop are shown in Table 1.

Table 1. Nitrogen fertilizer rates based on previous crops.

Previous crops	Lb. N/acre*
Grain or corn (residue returned)	200
Grain or corn (residue removed)	160
Row crop	140
Beans, peas, alfalfa stubble	100
Green manure legumes	80

*Reduce rates 20 pounds per acre for seed corn.

Nitrogen Soil Test

A nitrogen soil test can evaluate the carryover from heavily fertilized row crops such as onions, beets or potatoes. Since nitrate nitrogen (NO_3-N) is mobile, the soil samples should represent soil depths of 0 to 12 and 12 to 24 inches, or the effective root zone. (Nitrogen soil test following alfalfa has limited value.)

The soil test values in Table 2 represent the sum of the nitrate nitrogen and ammonium nitrogen in the top 2 feet of soil by 1 foot increments.

Table 2. Nitrogen fertilizer rates based on soil test.

0-24 inch depth or effective root zone N (ppm)*	Nitrogen application Lb./acre**
0	160
10	120
20	80
30	40
40 plus	0

* ppm x 4 = pounds nitrogen per acre

** reduce rates 20 pounds per acre for seed corn. Add 15 pounds nitrogen for each ton of grain straw or non-legume residue plowed under up to 60 pounds nitrogen per acre. Straw yields are normally 3 to 4 tons per acre.

PHOSPHORUS (P)

Corn will respond to phosphorus fertilizer if soil levels are low. The soil test is based on available phosphorus present to the depth of plowing and the soil samples should represent this area. Phosphorus should be plowed down or banded in the seedbed.

Table 3 shows soil test levels and rates of phosphorus to apply. Since soil samples are being taken both at plow depth (0 to 9 inches) and at 0- to 12-inch depth, levels for both depths are shown.

Table 3. Phosphorus fertilizer rate based on soil test.

Soil test inches soil depth 0-9	0-12	Apply lb./acre	
phosphorus (P) ppm*		P_2O_5	(P)**
0	0	240	106
4	3	160	70
8	6	80	35
12 plus	10 plus	0	0

* Phosphorus (P) is by $NaHCO_3$ extraction.

** Phosphorus is expressed as both the oxide and elemental forms: P_2O_5 x 0.44 = P or P x 2.29 = P_2O_5.

POTASSIUM (K)

Corn has a moderate requirement for potassium. Fertilizer should be applied in fall or early spring and worked into seed bed. Table 4 shows soil test levels and rates of potassium to apply. Since soil samples are taken at both plow depth and the 0- to 12-inch soil depth, K levels for both depths are given.

Table 4. Potassium fertilizer rate based on soil test.

Soil test inches soil depth 0-9	0-12	Apply lb./acre	
potassium (K) ppm*		K_2O	(K)**
0	0	240	200
30	22	160	133
60	45	80	66
90	68	40	33
120	90 plus	0	0

* Potassium (K) is by $NaHCO_3$ extractant.

** Potassium is expressed as both the oxide and elemental forms: $K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$.

MICRONUTRIENTS

Zinc (Zn) — Corn is sensitive to zinc deficiency particularly on leveled or exposed limey subsoil areas. When the soil test for zinc is less than 0.6 ppm in the 0- to 12-inch soil depth, or if sub-soils are exposed, apply zinc fertilizer to supply 10 pounds of zinc per acre or equivalent.

Other micronutrients have not been shown to be limiting corn production and "shotgun" application of micronutrient mixtures containing boron, manganese, iron and copper "for insurance" have not been shown to be responsive and are not suggested.

SULFUR (S)

The major corn growing regions of Idaho should not experience sulfur deficiency. Soil testing less than 8 ppm SO_4-S in the 0- to 12-inch soil depth or areas known to be deficient in sulfur should receive 30 pounds sulfur per acre.

SALINITY (SALTS)

Some sweet corn inbred lines have a low tolerance to salty soils. Soils over 3 to 4 mmhos/cm may be too salty for salt sensitive inbreds. Field corn varieties will normally tolerate more salt than sweet corn varieties.

GENERAL COMMENTS

1. Results from fertilizer research trials are available in Idaho Experiment Station Bulletin 501, *Fertilizing Sweet Corn for Seed Production*, by C. G. Painter and W. R. Simpson.
2. Side-dressing may cause root pruning depending upon plant size, distance of shank from the row, and depth. Stalk rot incidence is also increased by this practice.
3. Over-irrigation and nitrogen leaching are a hazard on all soils, particularly sandy-textured soils.
4. Irrigation, weed and disease control, variety, and plant population will influence the effectiveness of your fertilizer applications.

If you have any questions regarding the interpretation of this information, please contact your County Extension Agent.

Prepared by C.G. Painter in cooperation with W.R. Simpson and J.P. Jones Department of Plant and Soil Sciences, University of Idaho College of Agriculture.

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, James L. Graves, Director of Cooperative Extension Service, University of Idaho, Moscow, Idaho 83843. We offer our programs and facilities to all people without regard to race, creed, color, sex or national origin.

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CORN PRODUCTION
UNIT 18

ANSWERS TO ASSIGNMENT SHEETS

Assignment sheet #1

PART I

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				
196	120	53	20	17	0	0	—	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

Part II

A. 1. 4 tons/acre
   2. 50 lbs. N/acre

B. 24 inches

C. 12 inches

D. Evaluated to satisfaction of instructor

Assignment sheet #2

Part I

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				
80	173	76	0	0	0	0	—	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

ANSWERS TO ASSIGNMENT SHEETS

Part II

A. Nitrogen rates depend on some of the following factors: length of growing season, previous crop, past fertilizer use, soil type and leaching hazard, and a realistic yield goal for the grower and the area.

B. Nitrogen fertilizer should be applied preplant and incorporated. Late side dressing will encourage stalk rot which is more prevalent in seed than processed corn.

C. 50 lbs. N/acre

D. Evaluated to satisfaction of instructor

CORN PRODUCTION
UNIT 18

NAME________________________________ SCORE____________

1. Match terms associated with corn production to the correct definitions. Write the correct numbers in the blanks.

1. Forage
2. Grain
3. Ensile
4. Silage
5. Hybrid
6. Tassel
7. Lodging
8. Stover
9. Fodder
10. Cultivation
11. Competition

_____a. Tillage to control weeds

_____b. Forage chopped and stored at 60 to 70 percent moisture and allowed to ferment and produce acids which then preserve it

_____c. Vegetative material in a fresh, dried, or ensiled state which is fed to livestock

_____d. Process where by individuals or groups directly inhibit the growth of others by utilizing resources potentially available to all

_____e. The mature stalks of corn from which the grain has been removed

_____f. The offspring of two parents which differ in one or more heritable characters

_____g. The seed of crops such as corn, wheat, barley, and oats

_____h. The flower on the upper portion of the stem of corn; it contains the stamens

_____i. The entire plant of grasses, such as corn, which is harvested, cured, and fed

_____j. A process wherein fresh or slightly wilted forage is placed in air-tight storage and allowed to ferment and produce acids which then preserve it

_____k. A condition that occurs when the stems are not strong enough to hold the plants erect and they bend or break over

TEST

2. List three uses of corn.

a. ______________________________

b. ______________________________

c. ______________________________

3. Select from the following list leading corn producing states. Write an "X" in the blank before each correct answer.

_____a. Iowa

_____b. Minnesota

_____c. Idaho

_____d. Ohio

_____e. Montana

_____f. Illinois

4. Select from the following list true corn facts. Write an "X" in the blank before each correct answer.

_____a. U.S. produces over 30% of world corn crop

_____b. Corn can be grown in every state, except Alaska

_____c. Corn ranks first in acreage among field crops in the world

_____d. The U.S. accounts for over 75% of world corn exports

_____e. Corn is represented in the FFA emblem

5. Discuss the economic importance of corn production to Idaho.

____

____

____

____

____

____

____

____

TEST

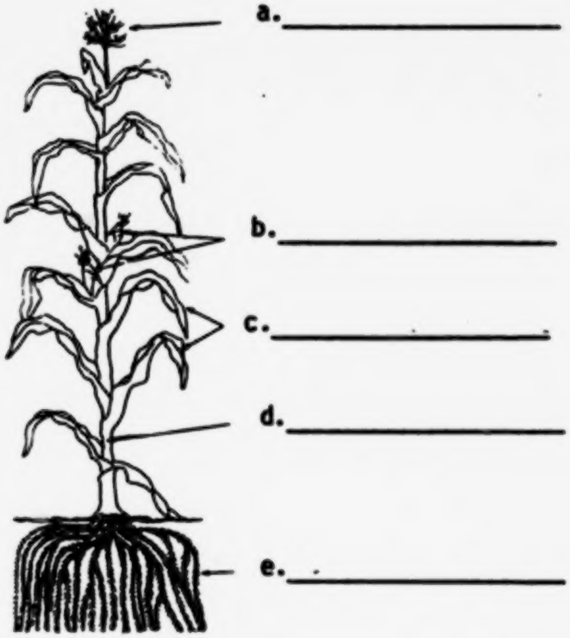
6. Name three types of corn.

   a.____

   b.____

   c.____

7. Identify the parts of a corn plant. Write the correct names in the blanks.



8. Arrange in order the stages of growth of the corn plant. Write a "1" before the first stage, a "2" before the second stage, and so on.

   _____a. Mature stage

   _____b. Two-leaf stage

   _____c. Dent stage

   _____d. Six-leaf stage

   _____e. Dough stage

   _____f. Ten-leaf stage

   _____g. Blister-stage

   _____h. Fourteen-leaf stage

   _____i. Pollination and fertilization

   _____j. Tassell emergence

TEST

9. List three purposes for which corn is grown in Idaho.

a.____

b.____

c.____

10. Select from the following list advantages of using hybrid corn. Write an "X" in the blank before each correct answer.

_____a. Withstand drought better

_____b. Requires less fertilizer

_____c. Produces higher yields

_____d. Better quality grain and forage

_____e. Irrigation is not required

11. List three tillage operations involved in seedbed operation.

a.____

b.____

c.____

12. Select from the following list characteristics of a desirable seedbed. Write an "X" in the blank before each correct answer.

_____a. Relatively cold

_____b. Moisture availability adequate

_____c. Loose enough for good air circulation

_____d. Minimum of competition from weeds

_____e. Warm

_____f. Fine enough to give good contact between seed and soil

TEST

13. Select from the following list factors to consider in planting corn. Write an "X" in the blank before each correct answer.

_____a. Time of planting

_____b. Soil temperature

_____c. Seeding depth

_____d. Plant population per acre

_____e. Rowspacing

14. List three factors that influence rate of planting.

a.______________________________

b.______________________________

c.______________________________

15. Select from the following list factors which influence final plant populations. Write an "X" in the blank before each correct answer.

_____a. Vigor of seedling

_____b. Cost of additional plant nutrients

_____c. Availability of plant nutrients

_____d. Amount of seed planted

_____e. Depth at which seed is sown

_____f. Germination percentage of seed

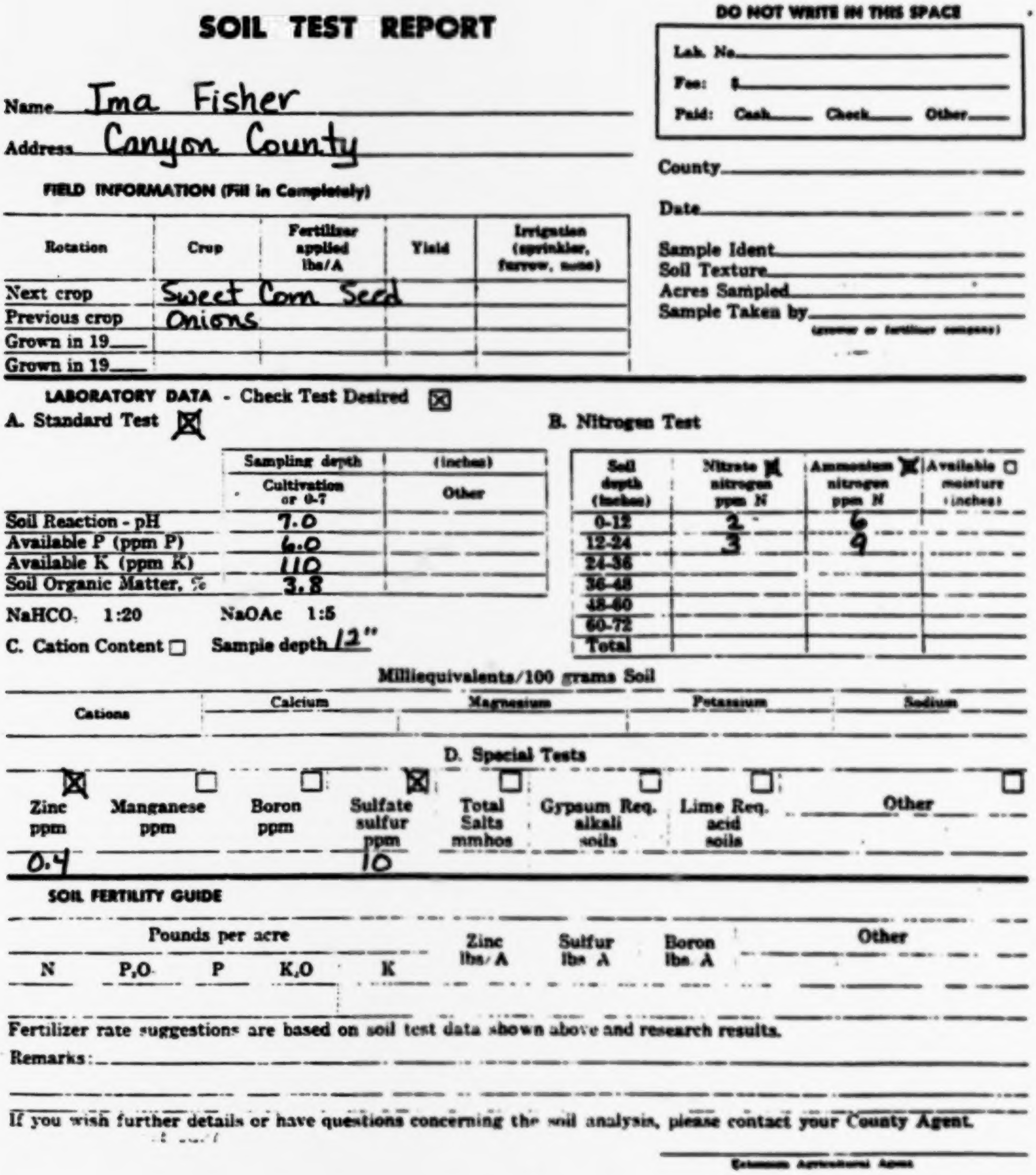
_____g. State in which crop is being raised

_____h. Price of certified seed

_____i. Competition from weeds

_____j. Time of planting

16. Using the information provided on the soil test report for Ima Fisher, recommend the amount of each nutrient that will need to be applied to achieve an average yield. Refer to fertilizer guide in making recommendations. Show all work.



SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No.________
Fee: $________
Paid: Cash____ Check____ Other____

Name Ima Fisher
Address Canyon County

County________
Date________
Sample Ident.________
Soil Texture________
Acres Sampled________
Sample Taken by________ (grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Sweet Corn Seed			
Previous crop	Onions			
Grown in 19___				
Grown in 19___				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth	(inches)
	Cultivation or 0-7	Other
Soil Reaction - pH	7.0	
Available P (ppm P)	6.0	
Available K (ppm K)	110	
Soil Organic Matter, %	3.8	

$NaHCO_3$ 1:20 NaOAc 1:5

B. Nitrogen Test

Soil depth (inches)	Nitrate ☒ nitrogen ppm N	Ammonium ☒ nitrogen ppm N	Available ☐ moisture (inches)
0-12	2	6	
12-24	3	9	
24-36			
36-48			
48-60			
60-72			
Total			

C. Cation Content ☐ Sample depth 12"

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

Zinc ppm ☒	Manganese ppm ☐	Boron ppm ☐	Sulfate sulfur ppm ☒	Total Salts mmhos ☐	Gypsum Req. alkali soils ☐	Lime Req. acid soils ☐	Other ☐
0.4			10				

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:________

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

____
Extension Agricultural Agent

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TEST

17. Name two corn diseases.

a.____

b.____

18. Name two harmful insects of corn.

a.____

b.____

19. Discuss how weeds compete with corn.

____

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20. List three ways weeds cause losses in corn production.

a.____

b.____

c.____

21. Match the general categories of weeds to the correct description. Write the correct numbers in the blanks.

1. Annual
2. Perennial
3. Broad leaf
4. Grass

_____a. Plant with longer, narrower leaves with parallel veination; monocots

_____b. Complete life cycle within a period of one year

_____c. Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

_____d. Plant with shorter, wider leaves that usually has pinnate or netted veination; dicots

TEST

22. Name three methods of weed control.

a.____

b.____

c.____

23. Select from the following list herbicides used to control weeds in corn. Write an "X" in the blank before each correct answer.

_____a. Atrazine

_____b. 2,4-D

_____c. Copper sulphate

_____d. Banvel

_____e. Roundup

_____f. Basagran

24. List three characteristics of high quality silage.

a.____

b.____

c.____

25. Select from the following list factors to consider in harvesting high quality silage. Write an "X" in the blank before each correct answer.

_____a. Harvest at correct plant moisture content

_____b. Pack tightly in pit or silo

_____c. Add water to bring silage to 65% moisture, if necessary

_____d. Cover pit with air-proof material

_____e. Leave pit uncovered so air can circulate

TEST

26. Discuss the harvesting and storing of grain corn.

____

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____

27. Match the types of corn markets to the correct description. Write the correct numbers in the blanks.

1. Cash market
2. Futures market

_____a. Contracting to purchase or deliver a certain amount of grain on a given date at a given price

_____b. Operates in the same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold

CORN PRODUCTION
UNIT 18

ANSWERS TO TEST

1. a. 10 d. 11 g. 2 j. 3
   b. 4 e. 8 h. 6 k. 7
   c. 1 f. 5 i. 9

2. a. Livestock feed
   b. Products for human consumption
   c. Industrial products

3. a, b, d, f

4. a, b, d, e

5. Evaluated to satisfaction of instructor

6. Answer should include any three of the following

   a. Dent
   b. Sweet
   c. Popcorn
   d. Flour corn
   e. Waxy corn

7. a. Tassel
   b. Ear
   c. Stem
   d. Leaves
   e. Roots

8. a. 10 d. 2 g. 7 j. 5
   b. 1 e. 8 h. 4
   c. 9 f. 3 i. 6

9. a. Field corn for grain
   b. Field corn for silage
   c. Sweet corn for processing or seed

10. a, c, d, f

11. Evaluated to satisfaction of instructor

12. b, c, d, e, f

13. a, b, c, d, e

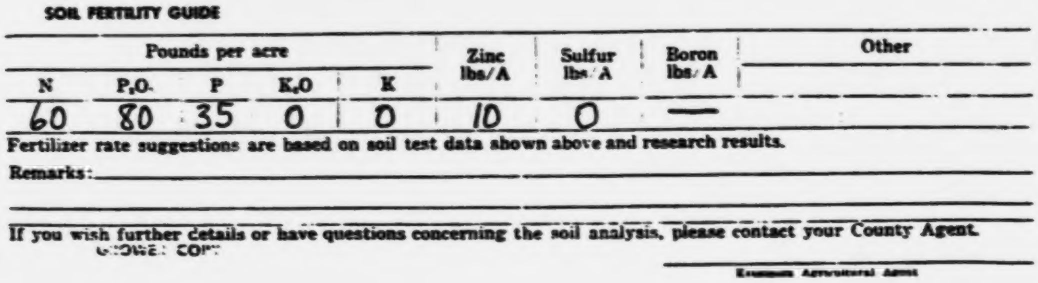
14. Answer should include any three of the following

    a. Time of planting
    b. Fertility of the soil
    c. Available supply of moisture
    d. Variety
    e. Purpose for which crop is grown

15. a, c, d, e, f, i, j

ANSWERS TO TEST

16.



SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				
60	80	35	0	0	10	0	—	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

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Extension Agricultural Agent

17. a. Corn smut b. Northern leaf blight

18. Answer should include any two of the following

    a. Western corn rootworm
    b. Corn earworm
    c. Western bean cutworm

19. Evaluated to satisfaction of instructor

20. a. Decreased yields
    b. Decreased crop quality
    c. Cost of control activities

21. a. 4 b. 1 c. 2 d. 3

22. a. Cultural b. Mechanical c. Chemical

23. a, b, d, e, f

24. Evaluated to satisfaction of instructor

25. a, b, c, d

26. Evaluated to satisfaction of instructor

27. a. 2 b. 1

FORAGE PRODUCTION
UNIT 19

UNIT OBJECTIVE

After completing this unit, the student should be able to describe forage production techniques involved with seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completing this unit, the student should be able to:

1. Match terms associated with forage production to the correct definitions.
2. Name the top three alfalfa producing states.
3. Discuss the economic importance of forage production to Idaho.
4. Name two legume and two non-legume forage crops.
5. Identify the parts of an alfalfa plant.
6. Select from a list factors to consider in selecting an alfalfa variety.
7. Select from a list characteristics of a desirable seedbed.
8. Select from a list factors to consider in planting.
9. List two advantages of a companion crop.
10. List two disadvantages of a companion crop.
11. Name three companion crops.
12. Calculate fertilizer requirements for alfalfa.
13. Name two forage diseases.
14. Name two harmful insects of forage crops.
15. Discuss how weeds compete with forage crops.
16. List three losses caused by weeds in forage crops.
17. Match the general categories of weeds to the correct description.

OBJECTIVE SHEET

18. List three methods of weed control.
19. Select from a list herbicides used to control weeds in alfalfa.
20. Select from a list characteristics of high quality hay.
21. List three factors to consider in cutting alfalfa hay.
22. List four methods of processing hay.
23. List two factors to consider in buying and selling alfalfa hay.

FORAGE PRODUCTION
UNIT 19

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. Forage, instructional unit available from: Agri-Farm Publications, Inc., 1019 Market St., Gowrie, IA, 50543; approx. cost $13.80; order no. 208; class activity packet on forage production, aprox. cost $4.75, order no. 1109; forage production guide available, approx. cost $3.90; order no. 2104.

      b. Forages: The Science of Grassland Agriculture. (1985). 4th edition. M.E. Heath, R.F. Barnes, and D.S. Metcalf. Iowa State University Press, Ames, Iowa. Price - $35.00.

      c. Alfalfa Science and Technology. (1972). American Society of Agronomy, Monograph #15. Madison, Wisconsin.

      d. Principles of Field Crop Production. (1976). Martin, J.H., Leonard, W.H., and Stamp, D.L. Macmillan Publishing Co.,Inc. New York.

    2. Filmstrips, slideshows, etc.

      a. "Diseases of Alfalfa", 42-frame filmstrip and script available from: Ohio Agriculture Education Curriculum Materials Center, Ohio State University, Columbus, OH, 43210; approx. cost $6.40, order no. 113X.

      b. "Diseases of Clover", 40-frame filmstrip and script available from: Ohio Agriculture Education Curriculum Materials Center, Ohio State Univeristy, Columumbus, OH, 43210; approx. cost $6.10, order no., 114X.

    3. Films

SUGGESTED ACTIVITIES

B. Make transparencies

C. Provide students with objective sheet

D. Provide students with information and assignment sheets

E. Discuss unit and specific objectives

F. Discuss information and assignment sheets

G. Do a community survey on alfalfa production and publish the results in local paper

H. Invite local alfalfa specialist to speak on alfalfa production

I. Arrange for a field trip to view harvesting and handling of alfalfa

J. Make arrangements with a seed company for class to visit local test plots and variety trials

K. Collect and use dried plant material of major grasses and legumes; also collect and display seeds of forages

L. Give test

M. Reteach if necessary

N. Retest

II. Instructional materials

  A. Objective sheet

  B. Suggested activities

  C. Information sheet

  D. Transparency masters

    1. TM 1--Leading alfalfa producing states

    2. TM 2--Alfalfa cut for hay

    3. TM 3--Common forage crops

    4. TM 4--Parts of an alfalfa plant

    5. TM 5--Selecting an alfalfa variety

    6. TM 6--Potential yield levels of irrigated alfalfa in southern Idaho

SUGGESTED ACTIVITIES

7. TM 7--Factors to consider in planting

8. TM 8--Characteristics of high quality alfalfa hay

9. TM 9--Effects of advancing maturity on the feed value, yield and digestibility of alfalfa hay

10. TM 10--Alfalfa crude protein with stages of maturity

11. TM 11--Alfalfa dry matter yield with stages of maturity

12. TM 12--Alfalfa digestible energy with stages of maturity

13. TM 13--Gains in weight of steers affected by the maturity of alfalfa fed

14. TM 14--Effects of stage of maturity of green-chopped alfalfa-brome forage on digestibility, forage intake and milk production

E. Assignment sheets

1. AS 1--Make fertilizer recommendations for alfalfa

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. Delorit, R.J., et al. Crop production, 4th edition, Englewood Cliffs, New Jersey: Printice-Hall, Inc.

B. Ensign, R.D., et al. Idaho Forage Crop Handbook. University of Idaho, Current Informations Series No. 547. Moscow, ID: 1975.

C. Roylance, H.B. and Kolar, J.J. Producing Maximum Yields on Irrigated Alfalfa Hay. University of Idaho, Current Information Series No. 635. Moscow, ID: 1982.

D. Ensign, R.D., et al. Alfalfa Variety Performance and Use in Idaho. University of Idaho, Current Information Series No. 635. Moscow, ID: 1982

E. Painter, C.G., et al. Idaho Fertilizer Guide--Irrigated Alfalfa. University of Idaho, Current Information Series No. 375 and 447. Moscow, ID: 1978.

F. Ryerson, D.K., et al. Producing Maximum Alfalfa Hay Yields and Quality Under Irrigation. University of Idaho Bulletin No. 612. Moscow, ID: 1982.

SUGGESTED ACTIVITIES

G. Alfalfa Analyst. Certified Seed Council, Inc. Woodland, CA.

H. Hannaway, D.B. and Adams, H.P. Alfalfa Hay Quality and Testing. University of Idaho PNW 223. Moscow, ID: 1982.

I. Graham, J.H., et al. Compendium of Alfalfa Diseases. American Phytopathological Society, St. Paul, MN: 1979.

J. Hannaway, D.B. Selecting Alfalfa Varieties for the Pacific Northwest, University of Idaho PNW 244. Moscow, ID: 1984.

FORAGE PRODUCTION
UNIT 19

INFORMATION SHEET

I. Terms and definitions

A. Forage--Vegetative material in a fresh, dried, or ensiled state which is fed to livestock

B. Crown--The part of the plant usually at or just below ground level between the root and the shoot

C. Crowning--Plowing at a shallow depth in the fall to partially kill the plants in a tough hay sod in preparation for normal plowing and working in the spring

D. Regrowth--Crown bud regrowth

E. Resistance--Percentage of plants that resist disease

F. 1/10 bloom--One plant in ten in bloom

G. Ensile--A process wherein fresh or slightly wilted forage is placed in air-tight storage and allowed to ferment and produce acids which then preserves it

H. Silage--Forage chopped and stored at 60 to 70 percent moisture, allowed to ferment producing an acid condition which preserves it

I. Symbiotic nitrogen fixation--Nitrogen fixation by bacteria that live in the roots of leguminous plants

J. Inoculation--The application of symbiotic nitrogen-fixing bacteria to the seed of legumes or to the soil in which such legumes are to be grown

K. Green manure crop--A crop, usually a nitrogen-fixing legume, grown and plowed down while still green to add organic matter and nitrogen to the soil

L. Bloat--Puffing up or swelling due to the collection of gas in the rumen of the animal

M. Carotene--Provitamin A; it is found in the leaves and other green parts of plants, and when eaten is changed to vitamin A

INFORMATION SHEET

II. Leading forage producing states

- A. All hay production
  - 1. Wisconsin
  - 2. Iowa
  - 3. Minnesota
  - 4. California
- B. Alfalfa hay
  - 1. Wisconsin
  - 2. Iowa
  - 3. California
  - 4. Minnesota
  - 5. Nebraska
  - 6. Idaho
- C. Bluegrass seed production
  - 1. Oregon
  - 2. Washington
  - 3. Idaho
- D. Red clover seed
  - 1. Oregon
  - 2. Minnesota
  - 3. Michigan
  - 4. Washington
  - 5. Idaho

INFORMATION SHEET

E. Alfalfa seed

1. Calfornia
2. Idaho
3. Nevada
4. Washington
5. Oregon
6. Montana

III. Economic importance of forage production to Idaho (1984)

A. Alfalfa hay

1. 1,030,000 acres harvested
2. 3.9 tons per acre average yield
3. 4,017,000 tons total production
4. $214,909,500 total value

(Note: Total value calculated using value of $53.50 per ton for all hay. Alfalfa hay accounts for 91% of the total value of all hay. While alfalfa hay average yield was 3.9 tons per acre, the average yield for all other crops raised for hay was 1.7 tons per acre.)

IV. Common forage crops

A. Legumes

1. Alfalfa

(Note: Many varieties are available to the alfalfa producer. The variety used will depend on the local disease and insect problems, and on the adaptability of that variety to the area. Consult your local county extension agent or seed specialist to determine which variety will best fit your needs.)

2. Red clover
3. Birdsfoot trefoil

B. Grasses (non-legumes)

1. Smooth brome grass
2. Orchard grass
3. Tall fescue
4. Intermediate wheatgrass

V. Parts of an alfalfa plant

A. Leaves

B. Stems

C. Nodules

D. Roots

VI. Factors to consider in selecting an alfalfa variety

A. Disease resistance

(Note: A variety is considered resistant if over 30% of plants survive under known disease or insect infestation.)

B. Insect resistance

C. Adaptability to area

(Note: This would include factors such as winter hardiness, limited moisture, etc.)

D. Regrowth after hay harvest

E. Palatability

F. Yield over 5 year period

(Note: The selection of an alfalfa variety has become very confusing to many hay growers. Many new varieties have been released by private companies as well as state universities and the USDA. The new variety releases have been advantageous for the hay grower. Most varieties are high yielding, fast recovery, disease and insect resistant plants. They are capable of 10% to 20% increased yield over old varieties, depending on the disease and insect problems of local growing conditions. Lists are available rating the different varieties on the percent resistance bred into them, or by letter rating. This letter standard is set up by the Plant Variety Protection Board. The variety will be letter rated as:

S (susceptible)--1% to 5% resistant
LR (low resistance)--6% to 15% resistant
MR (moderate resistance)--16% to 30% resistant
R (resistant)--31% to 50% resistant
HR (high resistance)--more than 50% resistant

A grower can use these lists to compare varieties and aid in making their final decision when they know pest and disease problems for their area.)

VII. Characteristics of a desirable seedbed

- A. Firm and well packed
- B. Deep, well drained loam
- C. Fairly level
- D. Free of large clods
- E. Adequate available moisture
- F. Free of weeds

VIII. Factors to consider in planting

- A. Depth of planting
  - 1. Clay soil--1/4 to 1/2 inch
  - 2. Loam soils--1/4 to 1/2 inch
  - 3. Sandy soils--1/4 to 3/4 inch

    (Note: A seeding depth of over 3/4 inch will result in a very high mortality or very week seedlings.)

- B. Rowspacing--Six or seven inches

  (Note: Alfalfa is usually seeded with a drill equipped with depth regulators. Drills distribute the seed more uniformly and assure proper soil coverage to increase the possibility of successful stand establishment. Six or seven inches is the normal spacing for seeders on a drill. Just prior to sowing, inoculate legumes with proper rhizobia.)

- C. Time of seeding--Will vary depending upon elevation. Plant as early in the spring as possible, consistent with seedbed preparation and frost hazard

INFORMATION SHEET

(Note: In south west Idaho irrigated areas with a long growing season, forage crops may be successfully seeded as late as August 1 to August 15. This allows the seedling to become well established before fall freeze-up and results in minimum winter-killing as compared to later seeding. Late fall seeding is recommended where average rainfall is less than 12" annually.)

D. Rate of Seeding

1. Without a companion crop--12 to 15 pounds per acre

(Note: A good, thick stand is important for rapid establishment and prodauction of fine-stemed, weed-free, high quality alfalfa hay. Alfalfa planted without a companion crop normally results in the best stands of hay. Seeding rates of 12 to 15 pounds per acre will provide about 65 to 70 seeds per square foot. Generally only 30 to 40% of seedlings will survive from seed count. For good quality and production the starting stand count should be around 18-20 plants per square foot.)

2. With a companion crop--15-18 pounds per acre alfalfa plus 40 to 50 percent of normal seeding rate of the grain

(Note: Many growers prefer to seed alfalfa with a companion grain crop or with peas. Alfalfa seeded with a small grain crop sometimes results in thin or spotty stands due primarily to crop competition or lodging.)

XI. Advantages of a companion crop

A Reduction of erosion

B. Reduction of weed competition

C. Provides a source of income during the year the forage crop is becoming established

X. Disadvantages of a companion crop

A. Competition between alfalfa and companion crop for water nutrients and light

(Note: Companion crops should never be used in areas where a moisture shortage is likely to develop early in the season or non-irrigated farmland.)

B. Reduced forage yields

C. Sometimes results in thin or spotty stands

X. Companion crops

A. Peas

(Note: Peas are the best companion crop. Peas mature early and have less competitive effect on forage seedlings than any of the cereals.)

B. Barley

C. Oats

D. Spring Wheat

(Note: When cereal companion crops are used, the seeding rate should be reduced by one-half. Manage companion crop to promote legume seeding.)

XI. Fertilizer needs of alfalfa

(Note: Alfalfa hay removes large quantities of nutrients from the soil. Before planting alfalfa, have the soil tested and, if the soil test indicates fertilizer is needed, apply it as prepare the seedbed. Phosphorus and potassium can also be apllpied on established stands of alfalfa. Fall fetrtilizer applications are recommended for best results.)

A. Nitrogen--None required because alfalfa has nitrogen-fixing bacteria (rhizobium) that convert atmospheric nitrogen to a plant available form

B. Phosphorus--Very important to alfalfa production. Work into top 6 inches of seedbed 2 weeks before seeding

C. Potassium

(Note: Fertilizer guides are available from the University of Idaho that correlate with soil test results. Base fertilizer applications on soil test results. For assistance, contact your local county extension agent or crop management specialist.)

INFORMATION SHEET

XIII. Forage diseases

A. Phytophthora root rot

1. Symptoms--Yellowish-brown rotted areas on the roots that may extend to the crown, killing the plant; the rotted areas turn black later

   (Note: When tap root has rotted off, it is very likely that phytophthora is the cause.)

2. Causal agent--Soil-borne fungi, poorly drained soil

3. Methods of control

   a. Plant resistant varieties

   b. Crop rotation

B. Bacterial wilt

1. Symptoms--Yellowish-brown discoloration in the woody cylinder of the tap root. Plants become stunted with many yellow shoots having small, cupped leaves

2. Causal agent--Bacteria which survives in dead alfalfa tissue in the soil

3. Method of control

   a. Plant resistant varieties

   b. Crop rotation

C. Verticillium wilt

1. Symptoms--Wilting of upper leaves at prebud to floral stage; may affect only part of plant i.e. stem on one side of crown (this is a common characteristic of verticillium not common to other wilts); leaves curl along midrib and eventually die; yellowish to brown discoloration present in the woody cylinder of the tap root

2. Causal agent--Fungi

3. Method of control

   a. Plant resistant varieties

   b. Crop rotation

INFORMATION SHEET

D. Other important diseases

1. Spring black stem

2. Common leaf spot

3. Downey mildew

XIV. Harmful insects of forage crops

A. Alfalfa stem nematodes

1. Description--Small parasitic round worms about 1/64 to 1/8 inch long; they live in the soil and usually move into the plant through the roots

2. Damage--Live in plant tissue and cause direct damage to vascular system; thickened stem bases and reduced growth result

3. Method of control

a. Plant resistant varieties

b. Crop rotation

B. Pea aphid

1. Description--Large, bright green aphid

2. Damage--Sucks plant juices causing the plants to wilt

3. Method of control

a. Plant resistant varieties

b. Natural enemies

c. Chemical control

C. Spotted alfalfa aphid

1. Description--This tiny aphid is light yellowish-green or straw colored with rows of dark spots on its back

2. Damage--Sucks the juices from both the leaves and the stalks of the plant and, at the same time, injects a toxic substance which causes the leaves to curl, turn yellow, and drop off

INFORMATION SHEET

3. Control

    a. Natural enemies, e.g. lady beetle, damsel bugs, ands lacewing flies

    b. Plant resistant varieties

    c. Chemical control

D. Alfalfa weevil

1. Description--Newly emerged adult is grayish in color with a triangularly shaped brownish stripe down the back. As they get older, they become darker brown

2. Damage--Feeding on alfalfa by larval and adult forms

3. Control

    a. Natural enemies

    b. Use good cultural practices

    c. Chemical control

XV. Weed competition with forage crops

A. Competition for water

B. Competition for plant nutrients

C. Competition for light

(Note: Forage crops and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XVI. Losses caused by weeds

A. Decreased yield

B. Decreased crop quality

1. Reduced total digestible nutrients

2. Redeuced total digestible protein

3. Reduced palatability

C. Cost of control activities

INFORMATION SHEET

XVII. General categories of weeds

A. Annual--Completes life cycle within a period of one year

B. Perennial--Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

C. Broadleaf--Plant with shorter, wider leaves that usually have pinnate or netted veination: dicots

D. Grass--Plant with longer, narrower leaves with parallel veination: monocots

XVIII. Methods of weed control

A. Cultural

B. Mechanical

C. Chemical

XIX. Control weeds in alfalfa with herbicides

(Note: Before you use herbicides, read and understand the direction on the container label. Follow these directions carefully. Refer to University of Idaho Weed Control Handbook for further helpful hints.)

A. Weed problem--Annual broadleaf and/or grasses (new alfalfa)

1. Eptam

2. Avadex (wild oats only)

3. ChemHoe

4. Kerb

B. Weed problem--Annual broadleaf in established alfalfa

1. 2, 4-DB

2. MCPA

C. Weed problem--Annual grasses in established alfalfa

1. ChemHoe

INFORMATION SHEET

D. Weed problem--Annual broadleaves and grasses in established alfalfa

1. Lexone
2. Sencor
3. Karmex
4. Treflan
5. Princep
6. Sinbar
7. Eptam
8. Paraquat
9 Vertac General

E. Weed--Dodder

1. Furloe
2. Furloe 4EC + Sevin
3. Kerb
4. Vertac General

XX. Characteristics of high quality alfalfa hay

A. Leafiness

(Note: High quality hay contains about 50% leaves. These leaves provide 50 to 75 percent of the digestible matter, 70 percent of the protein and 90 percent of the carotene found in alfalfa hay. Any leaf loss reduces the nutritive value in hay.)

B. Harvested at correct stage of maturity

(Note: As alfalfa gets closer to full maturity, the less the amount of total digestible nutrients. Nutrients, especially protein and phosphorus, are at their highest level at bud state of the plant. The best time for harvesting is at first bloom. Do not wait until 1/2 bloom.)

INFORMATION SHEET

C. Natural green color

(Note: Bright green hay indicates high levels of carotene. Bright, prolonged sunlight will destroy this valuable provitamin on mowed hay.)

D. Free of foreign material

(Note: Weeds and other foreign material result in decreased palatability and feeding value.)

E. Correct moisture content

(Note: For baled hay, trhe moisture for storage should be 15 to 20 percent. Hay of a higher moisture content should not be stored. In addition to the danger of molding the hay, there is a possibility of spontaneous combustion resulting in a costly fire.)

XXI. Factors to consider in cutting alfalfa hay

A. Cut at correct stage of maturity

(Note: Recommended stage of maturity for cutting of alfalfa hay is when one plant in ten has primary bloom, or not more than 1/2 or 3/4 crown bud regrowth.)

B. Put into windrows

(Note: Fewer leaves are lost when the hay is put into windrows. Since the leaves contain more nutrients than the stems, it is important to save as many of them as possible. Windrows should be wide, flat, and fluffy to facilitate faster drying. A swather will cut, condition, and put hay into windrows in one operation.)

C. Use hay conditioner on swather

(Note: Proper setting of conditioner will leave wide, flat, and fluffy windrows to facilitate faster drying of hay than high, tight windrows. Tests have shown that the use of a hay conditioner will reduce hay drying time by about one full day.)

INFORMATION SHEET

D. Turn windrows over when necessary

(Note: Turning windrows at 30% moisture will speed up drying and removal of hay by a least 24 hours. This will reduce the chance of rain damage. Also the faster the hay can dry and be removed, the less damage to regrowth of following crop. If hay is rained on when it is still in the windrow, it may be necessary to turn it over with a rake to prevent spoilage. Rake two windrows into one so that fewer passes with baler will be required and to reduce soil compaction.)

E. Last crop should be cut 4 to 5 weeks prior to first killing frost

(Note: In some areas it is best to leave the crop until the first killing frost and then cut to prevent regrowth. The time lapse between the last hay cutting and the first killing frost must allow enough regrowth to occur to replenish the root reserves for winter hardiness and early spring growth. The residue after killing frost may be grazed or removed for hay.)

XXII. Methods of processing hay

A. Baling

(Note: Baling is a general term and may refer to two-string, three-string, or one-ton bales. Most bales to be used on the home farm are two-string bales or the one-ton round bales if handling equipment is available. Most bales for export out of state are three-string.)

B. Chopping

(Note: Where alfalfa is to be used on the farm where produced, chopping of the cured hay in the field may be practical. Advantage of chopped hay is less waste since stock will consume both leaves and stems. Since chopped hay packs tightly, it must have a low moisture content of 10 to 14 percent at time of storage.)

C. Pelleting and wafering

(Note: These processes make the hay into a compact and convenient form for handling and feeding. Pellets require less storage and fit in today's continuous-flow feeding systems.)

INFORMATION SHEET

D. Alfalfa meal

E. Haylage

F. Silage

XXIII. Factors to consider in buying and selling alfalfa hay

(Note: Alfalfa supplies a major share of feed nutrients for the dairy and livestock industry of Idaho. Since the concentration of nutrients is quite variable in most feeds, value is also variable., Differences in nutrient content mean dollars and cents to the livestock or dairy producer.)

A. Maturity at which hay was harvested

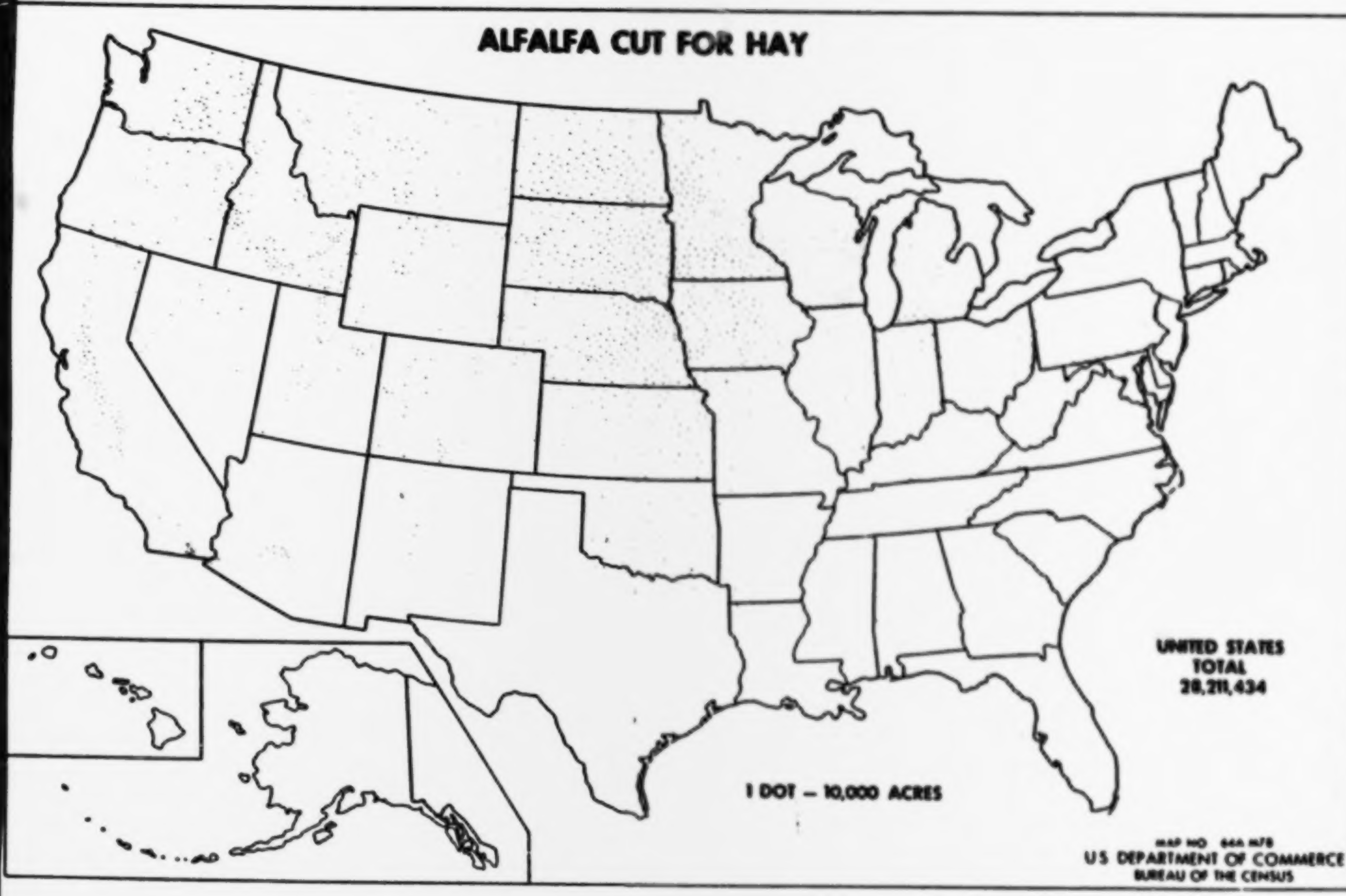
B. Crude Protein

C. Moisture or dry matter

(Note: Using a combination of crude protein and dry matter, average selling price can be adjusted to reflect the nutrient and feeding value of the hay. Refer to University of Idaho CIS #539, Setting a Price For Alfalfa Feeds, for further information or contact your local county extension agent.)

Leading Alfalfa Producing States

1. Wisconsin
2. Iowa
3. California
4. Minnesota
5. Nebraska
6. Idaho



ALFALFA CUT FOR HAY

UNITED STATES
TOTAL
28,211,434
1 DOT – 10,000 ACRES
MAP NO. 64A M/B
U S DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Common Forage Crops

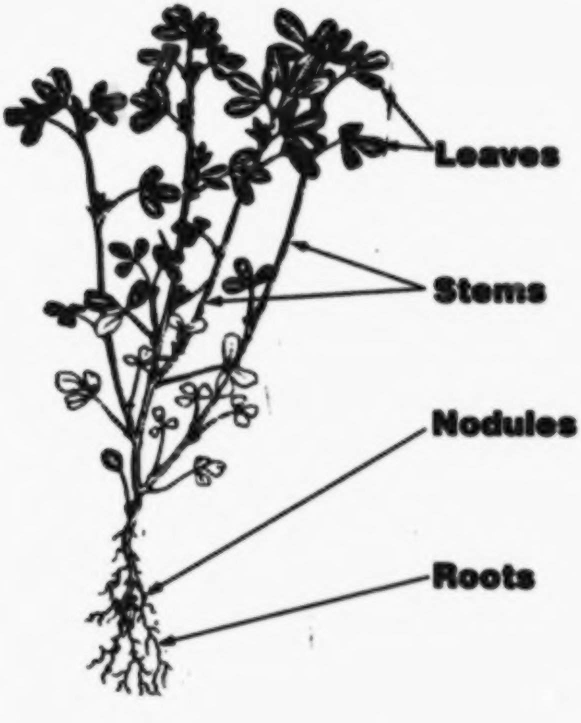
Legume

1. **Alfalfa**
2. **Red Clover**
3. **Birdsfoot Frefoil**

Non-Legume

1. **Smooth Brome Grass**
2. **Orchard Grass**
3. **Tall Fescue**
4. **Intermediate Wheatgrass**

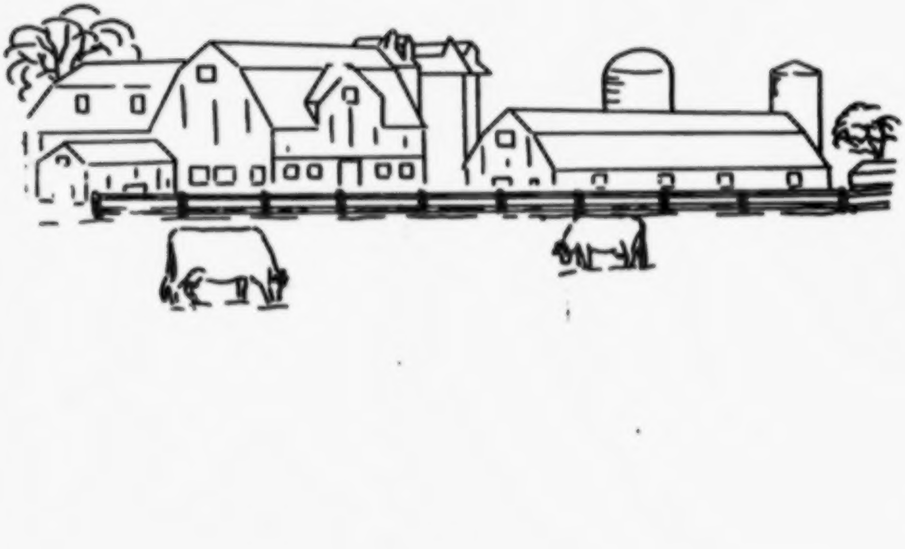
Parts of an Alfalfa Plant


Leaves
Stems
Nodules
Roots

CSS 19 25

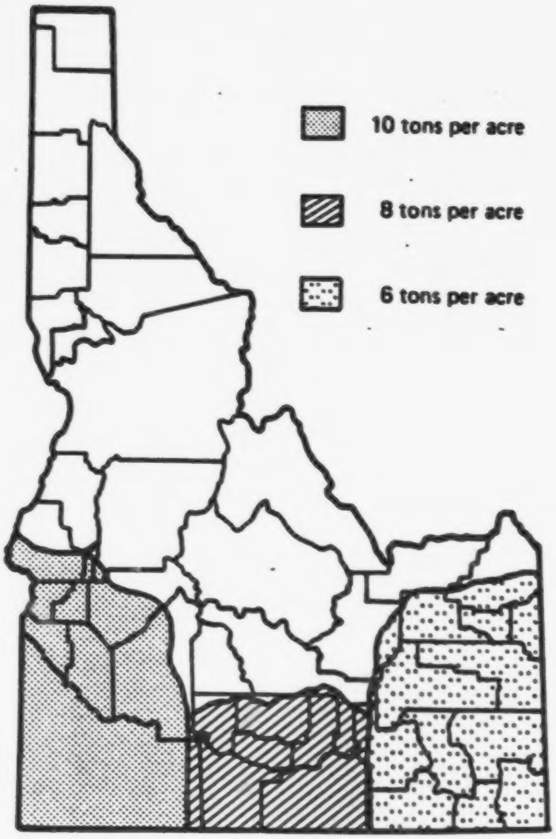
Factors to Consider in Selecting an Alfalfa Variety

1. Disease Resistance
2. Insect Resistance
3. Adaptability to area
4. Regrowth after harvest
5. Palatability
6. Yield over 5 year period



CSS 19 27

Potential Yield Leves of Irrigated Alfalfa in Southern Idaho


10 tons per acre
8 tons per acre
6 tons per acre

738

TM #6

Factors to Consider in Planting

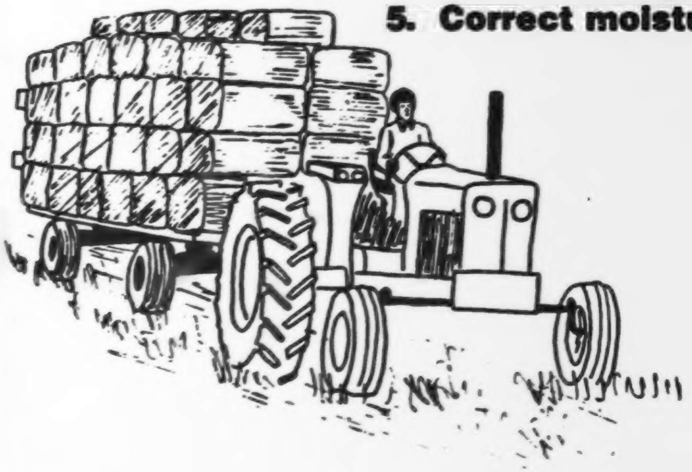
1. **Depth of planting**
2. **Rowspacing**
3. **Time of seeding**
4. **Rate of seeding**

TM #7

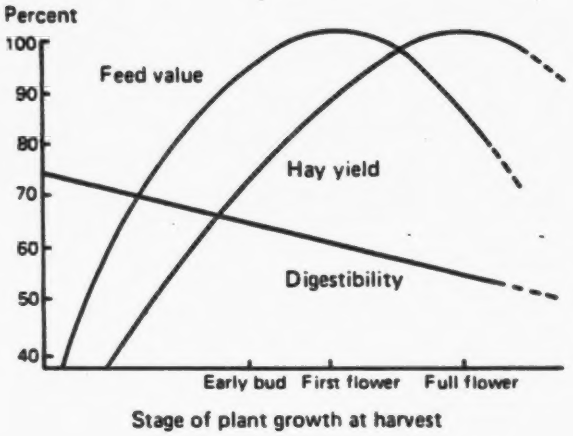
CSS 19 28

Characteristics of High Quality Alfalfa Hay

1. Leafiness
2. Harvested at correct stage of maturity
3. Natural green color
4. Free of foreign material
5. Correct moisture content



Effects of Advancing Maturity on the Feed Value, Yield and Digestibility of Alfalfa Hay



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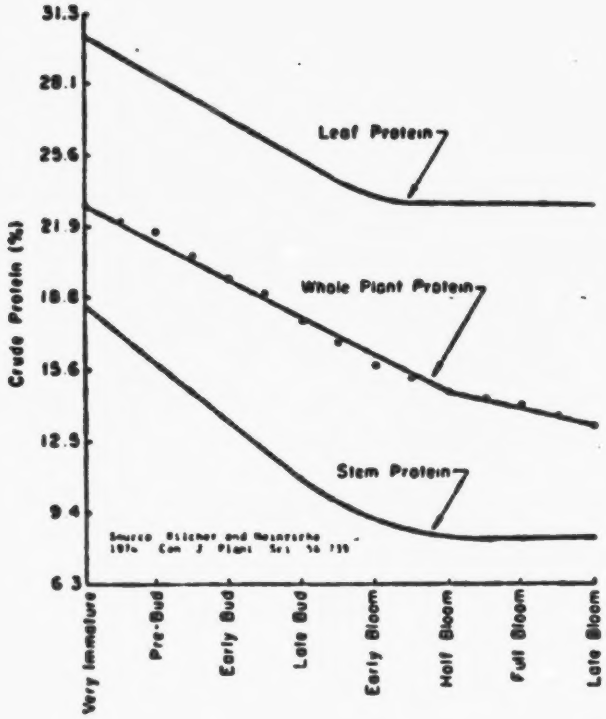
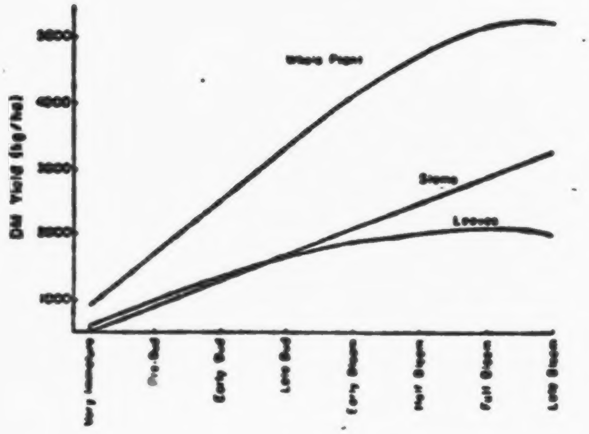
Alfalfa Crude Protein with Stages of Maturity



Source Kilcher and Heinrichs 1974 Can J Plant Sci 54 739

Alfalfa Dry Matter Yield with Stages of Maturity



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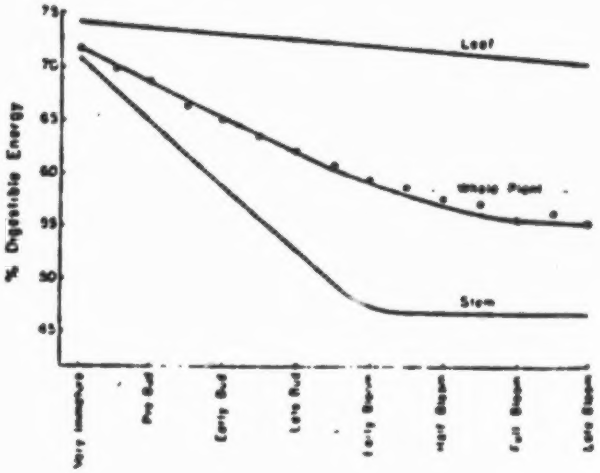
CSS 19 33

Alfalfa Digestible Energy with Stages of Maturity



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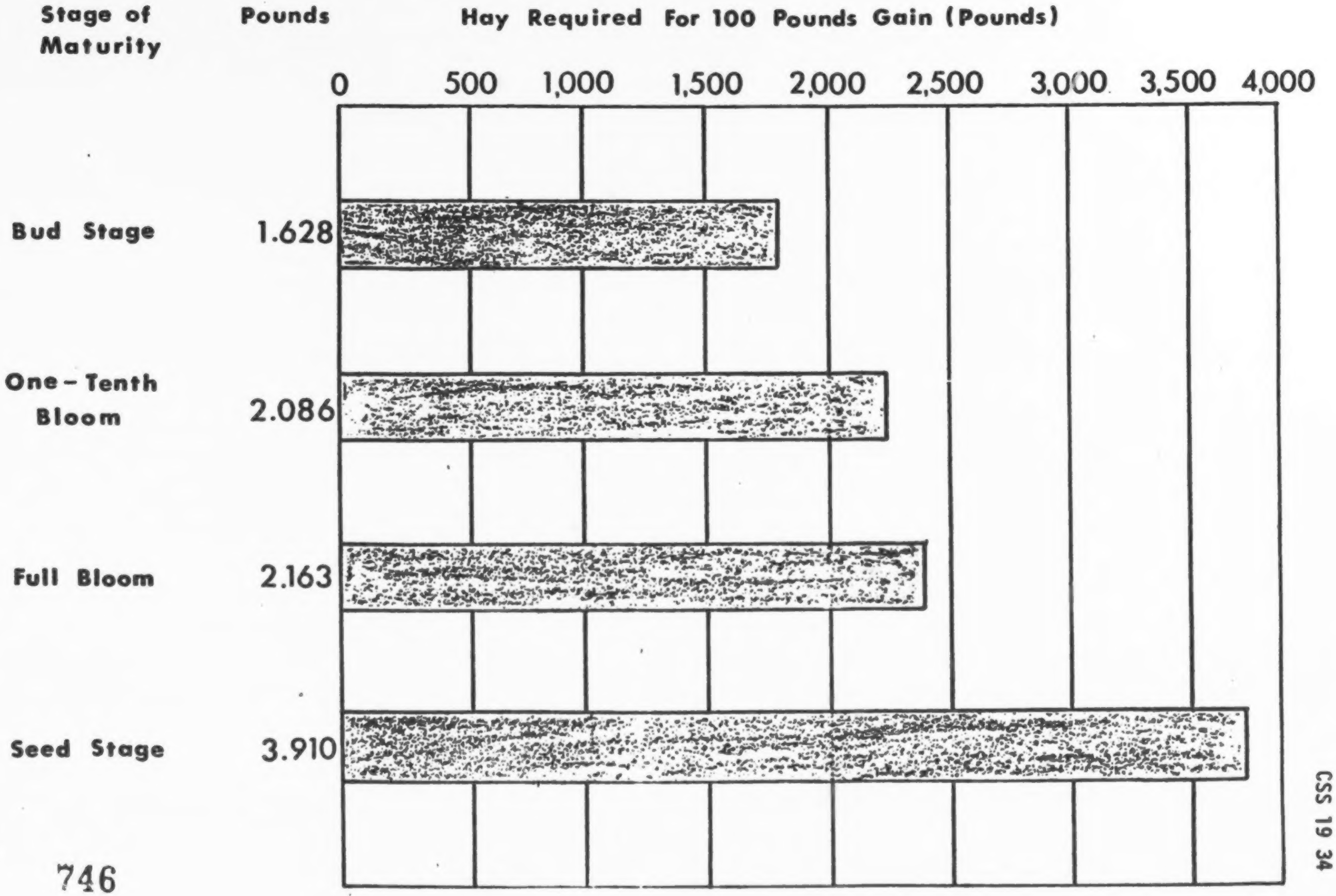
TM #12

Gains in Weight of Steers Affected by the Maturity of the Alfalfa Fed.



Effects of Stage of Maturity of Green-Chopped Alfalfa-Brome Forage on Digestibilty, Forage Intake and Milk Production.[1]

Stage of Maturity	Harvest Date	Dry Matter Digestibility	Dry Matter Intake	Digestible Dry Matter Intake	Fecal Dry Matter	Milk Production	Amount of Grain Needed
		%	lbs/day[2]	lbs/day[2]	lbs/day[2]	lbs/day	lbs/day[3]
Alfalfa							
prebud	5/17	66.8	34.0	23.0	11.1	42.5	4.0
bud	5/24	65.0	33.2	21.6	11.6	39.5	5.7
early bloom	5/31	63.1	32.0	20.2	11.8	31.4	8.4
midbloom	6/7	61.3	30.6	18.8	11.8	31.4	10.9
full bloom	6/14	59.4	29.2	17.4	11.8	26.5	13.5
late bloom	6/21	57.5	27.8	16.0	11.8	23.4	15.7
mature	6/28	55.8	26.3	14.7	11.6	19.5	18.2

[1] Fed free-choice with 3 to 5 lbs. concentrate.

[2] Pounds per day per 1,000 pounds body weight.

[3] Amount of grain needed per 1,000 pound cow per day to have maintained the level of milk production on 5/17.

FORAGE PRODUCTION
UNIT 19

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ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR ALFALFA

NAME________________________________ SCORE______________

Using the information provided on the soil test report for Hey Maker, and the University of Idaho CIS #375 - Idaho Fertilizer Guide for Irrigated Alfalfa, recommend the amount of each nutrient that will need to be applied to achieve an average yield. Refer to the fertilizer guide for more complete directions.

PART I

SOIL TEST REPORT

DO NOT WRITE IN THIS SPACE

Lab. No.__________
Fee: $__________
Paid: Cash____ Check____ Other____

Name Hey Maker
Address Ada County

County__________
Date__________
Sample Ident.__________
Soil Texture__________
Acres Sampled__________
Sample Taken by__________
(grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Alfalfa			
Previous crop	Alfalfa			
Grown in 19____				
Grown in 19____				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth Cultivation or 0-7	(inches) Other
Soil Reaction - pH	7.1	
Available P (ppm P)	5.0	
Available K (ppm K)	84	
Soil Organic Matter, %	3.5	

NaHCO₃ 1:20 NaOAc 1:5

B. Nitrogen Test

Soil depth (inches)	Nitrate ☐ nitrogen ppm N	Ammonium ☐ nitrogen ppm N	Available ☐ moisture (inches)
0-12			
12-24			
24-36			
36-48			
48-60			
60-72			
Total			

C. Cation Content ☐ Sample depth 12"

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

☐ Zinc ppm	☐ Manganese ppm	☐ Boron ppm	☒ Sulfate sulfur ppm	☐ Total Salts mmhos	☐ Gypsum Req. alkali soils	☐ Lime Req. acid soils	☐ Other
			4.0				

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:____

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

____
Extension Agricultural Agent

ASSIGNMENT SHEET #1

PART II

A. Why is nitrogen fertilizer generally not needed for alfalfa?

B. In what situation would it be advisable to apply nitrogen fertilizer?

C. What nutrient is seldom deficient in areas irrigated with water from the Snake River?

D. Alfalfa fields in southern Idaho frequently become yellow during growth of the second and third crop. What would you recommend in this situation?

E. What other factors could affect the ability of alfalfa to get nutrients from the soil? (other than level of nutrients in the soil)

University of Idaho
College of Agriculture
Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 375
February 1978

Idaho Fertilizer Guide

Irrigated Alfalfa

The following fertilizer guidelines are based on relationships established between University of Idaho soil tests and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus, the fertilizer guide assumes use of good crop management practices.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples represent the area to be fertilized; and (2) the crop history information supplied is complete and accurate.

NITROGEN (N)

Nitrogen fertilizer is generally not needed for alfalfa. Responses to applied nitrogen usually indicate the alfalfa plant is not effectively nodulated due to lack of proper seed inoculation or an old stand.

When growers plant alfalfa with a companion crop, both crops compete for the nitrogen. Under these conditions rates of nitrogen at 30 to 40 pounds are suggested to hasten and establish alfalfa stands.

PHOSPHORUS (P)

Alfalfa responds well to applied phosphorus. The need for phosphorus fertilization can be determined by a soil test. Phosphorus materials should be broadcast and plowed down or worked into the seed bed prior to planting.

Table 1. Phosphorus fertilizer rates based on soil test.

Soil Test inches soil depth 0-8	0-12	Apply lb. per acre	
Phosphorus (P) ppm*		P_2O_5	(P)**
0	0	160	70
4	3	120	53
8	7	60	26
over 12	over 10	0	0

* P test is by the $NaHCO_3$ extractions.

** Phosphorus is expressed as both the oxide and elemental forms: $P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$.

Phosphorus applications on established stands can best be applied in the fall or early spring. Rates of phosphorus relative to soil test levels are given in Table 1. The recommended application is sufficient for 2 year's production.

POTASSIUM (K)

Potassium needs and removal by alfalfa are high. The need for potassium fertilization can be determined by soil test (Table 2).

Table 2. Potassium fertilizer rates based on soil test.

Soil Test inches soil depth 0-8	0-12	Apply lb. per acre	
Potassium (K) ppm*		K_2O	(K)**
0	0	240	200
75	56	160	133
150	112	80	66
over 200	150	0	0

* K test is by the $NaHCO_3$ extraction.

** Potassium is expressed as both the oxide and elemental forms: $K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$.

SULFUR (S)

Areas irrigated with Snake River water or any water containing large amounts of SO_4-S should not experience a shortage of sulfur. Mountain valleys and foothill areas receiving higher rainfall and heavy snows and irrigated with low sulfur water are likely areas for sulfur deficiency.

Sulfur demands by legumes such as alfalfa are greater than demands by grasses.

Soils testing less than 8 ppm sulfate sulfur (SO_4-S) in the 0- to 12-inch soil depth receive 40 pounds sulfur per acre. This rate of application should provide adequate sulfur for 2 years of production.

Fertilizer sources of sulfur include gypsum, elemental sulfur and sulfur contained in some nitrogen, phosphorus and potassium materials.

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MICRONUTRIENTS

Zinc (Zn) deficiencies on alfalfa have not been observed in Idaho. Crops such as beans, corn, potatoes and onions would normally exhibit zinc deficiency before alfalfa. Zinc applied to any of those crops would have sufficient residual for alfalfa.

BORON (B)

Boron deficiencies occur in a few areas in Idaho. However, they have not been widespread on Idaho alfalfa fields. Alfalfa is sensitive to low soil boron and deficiencies normally occur on acid, gravelly textured soils.

If the soil tests less than 0.25 ppm B, apply 1 to 3 pounds per acre of boron. Do not use higher rates as boron in excessive amounts is toxic to plants.

GENERAL COMMENTS

1. Complete information on cultural practices necessary for alfalfa production are contained in Idaho Current Information Series No. 144, *Producing Maximum Yields of Irrigated Alfalfa Hay*, revised January 1975.
2. Irrigation, weeds and insects can influence the effectiveness of your fertilizer application.
3. Alfalfa fields in Southern Idaho frequently become yellow during growth of the second and third crop. These fields have not responded to applications of fertilizer to correct this temporary yellowing condition.
4. Variety choice should consider length of time the stand is to be maintained, disease and insect resistance, regrowth rate and winterhardiness. If stands are to be maintained more than 2 years, special effort should be made to use wilt resistant winterhardy varieties.
5. Alfalfa can become a cash crop in the rotation by the application of needed management inputs such as water, fertilizer and pesticides and by timely harvesting.
6. Phosphorus is very important for animal nutrition and can greatly influence animal performance and animal health. Alfalfa hay should be analyzed to determine P content. Fertilization can increase P content of forage.

Prepared by Charles G. Painter, in cooperation with John J. Kolar, Harold R. Guenthner and J. Preston Jones, Department of Plant and Soil Sciences, University of Idaho College of Agriculture.

5 cents per copy

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture, James L. Graves, Director of Cooperative Extension Service, University of Idaho, Moscow, Idaho 83843. We offer our programs and facilities to all people without regard to race, creed, color, sex, or national origin.

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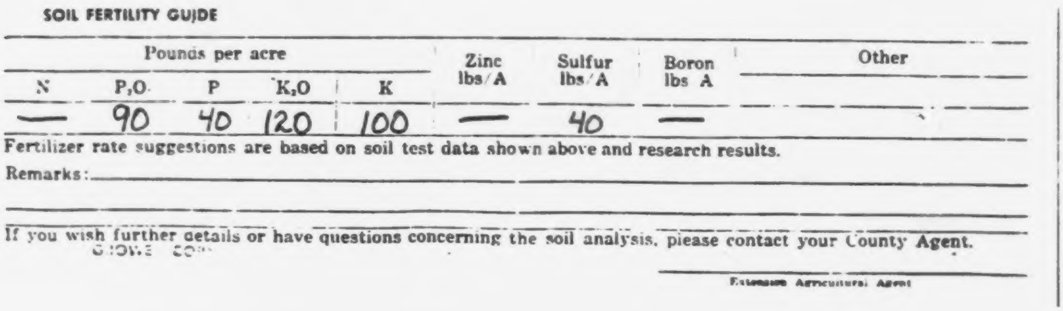
FORAGE PRODUCTION
UNIT 19

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

Part I



SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs A	Other
N	P_2O_5	P	K_2O	K				
—	90	40	120	100	—	40	—	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

Part II

A. Alfalfa can use atmospheric nitrogen with the help of rhizobia bacteria in nodules on roots
B. When seeding with companion crop
C. Sulphur
D. Condition is temporary; alfalfa will not respond to fertilizer application; no action taken
E. Evaluated to satisfaction of instructor

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FORAGE PRODUCTION
UNIT 19

TEST

NAME____ SCORE_______________

1. Match terms associated with forage production to the correct definitions. Write the correct numbers in the blanks.

1. Forage
2. Crown
3. Crowning
4. Regrowth
5. Resistance
6. 1/10 bloom
8. Silage
9. Ensile
10. Inoculation
11. Green manure crop
12. Bloat
13. Carotene

_____a. The part of a plant usually at or just below ground level between the root and the shoot

_____b. Nitrogen fixation by bacteria that live in the roots of leguminous plants

_____c. A process wherein fresh or slightly wilted forage is placed in air-tight storage and allowed to ferment and produce acids which then preserves it

_____d. Provitamin A; it is found in the leaves and other green parts of plants, and when eaten is changed to vitamin A

_____e. Vegetative material in a fresh, dried, or ensiled state which is fed to livestock

_____f. Crown bud regrowth

_____g. A crop, usually a nitrogen-fixing legume, grown and plowed down while still green to add organic matter and nitrogen to the soil

_____h. Percentage of plants that resist disease

_____i. The application of symbiotic nitrogen-fixing bacteria to the seed of legumes or to the soil in which such legumes are to be grown

_____j. Puffing or swelling due to the collection of gas in the rumen of the animal

_____k. Forage chopped and stored at 60 to 70 percent moisture, allowed to ferment producing an acid condition which preserves it

_____l. Plowing at a shallow depth in the fall to partially kill the plants in a tough hay sod in preparation for normal plowing and working in the spring

_____m. One plant in ten in bloom

TEST

2. Name the top three alfalfa producing states.

a.____

b.____

c.____

3. Discuss the economic importance of forage production to Idaho.

4. Name two legume and two non-legume forage crops.

a. Legume

1.____

2.____

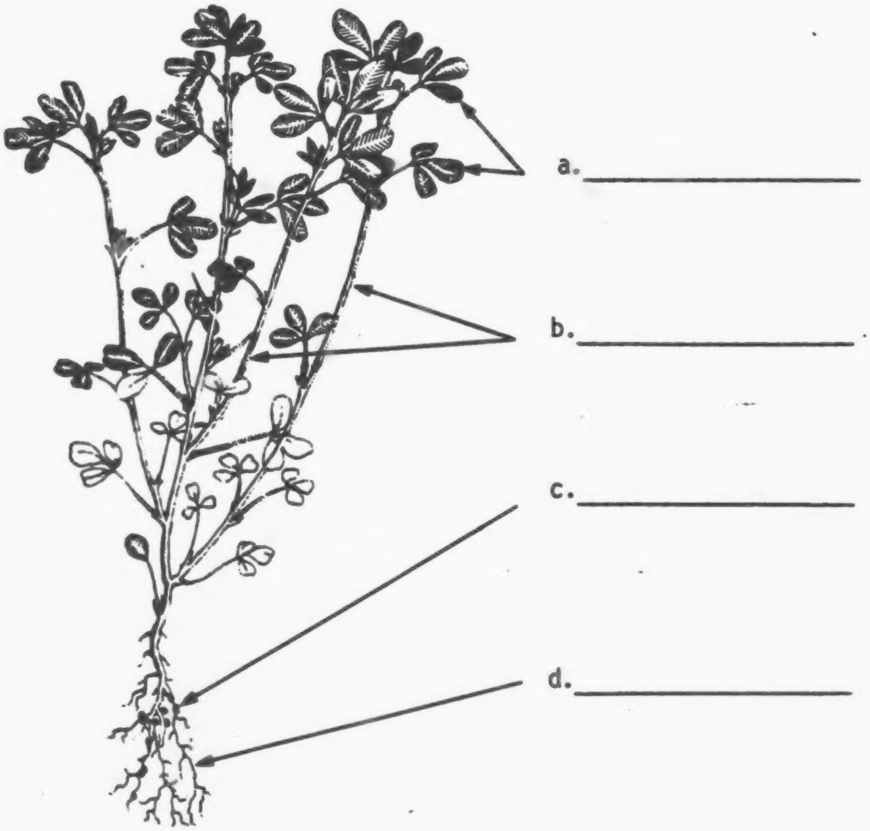
b. Non-legume

1.____

2.____

TEST

5. Identify the parts of an alfalfa plant. Write the correct names in the blanks.



6. Select from the following list factors to consider in selecting an alfalfa variety. Write an "X" in the blank before each correct answer.

_____a. Palatability

_____b. Yield over 5 year period

_____c. Disease resistance

_____d. Winter hardiness

_____e. Regrowth

_____f. Adaptability to area

TEST

7. Select from the following list characteristics of a desirable seedbed. Write an "X" in the blank before each correct answer.

_____a. Adequate available moisture

_____b. Minimum field slope of 25%

_____c. Large clod size acceptable

_____d. Free of weeds

_____e. Firm and well packed

_____f. Deep, well drained loam

8. Select from the following list factors to consider in planting. Write an "X" in the blank before each correct answer.

_____a. Do not plant more that 3/4 inch deep on sandy soil

_____b. Plant as early in the spring as possible

_____c. Inoculate legumes with proper rhizobia bacteria

_____d. Do not plant more than 1/2 inch deep on clay or loam soils

_____e. Rate of seeding

_____f. Rowspacing and method of seeding

9. List two advantages of a companion crop.

a. ____

b. ____

10. List two disadvantages of a companion crop.

a. ____

b. ____

11. Name three companion crops.

a. ____

b. ____

c. ____

TEST

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12. Using the information provided on the soil test report for High Stack, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide in making recommendations. Show all work.

SOIL TEST REPORT

Name High Stack
Address Gooding

DO NOT WRITE IN THIS SPACE
Lab. No.
Fee: $
Paid: Cash Check Other

County
Date
Sample Ident.
Soil Texture
Acres Sampled
Sample Taken by
(grower or fertilizer company)

FIELD INFORMATION (Fill in Completely)

Rotation	Crop	Fertilizer applied lbs/A	Yield	Irrigation (sprinkler, furrow, none)
Next crop	Alfalfa			
Previous crop	Alfalfa			
Grown in 19				
Grown in 19				

LABORATORY DATA - Check Test Desired ☒

A. Standard Test ☒

	Sampling depth (inches) Cultivation or 0-7	Other
Soil Reaction - pH	7.2	
Available P (ppm P)	3.0	
Available K (ppm K)	56	
Soil Organic Matter, %	2.7	

NaHCO₃ 1:20 NaOAc 1:5

C. Cation Content ☐ Sample depth 12"

B. Nitrogen Test

Soil depth (inches)	Nitrate ☐ nitrogen ppm N	Ammonium ☐ nitrogen ppm N	Available ☐ moisture (inches)
0-12			
12-24			
24-36			
36-48			
48-60			
60-72			
Total			

Milliequivalents/100 grams Soil

Cations	Calcium	Magnesium	Potassium	Sodium

D. Special Tests

☐ Zinc ppm	☐ Manganese ppm	☐ Boron ppm	☒ Sulfate sulfur ppm	☐ Total Salts mmhos	☐ Gypsum Req. alkali soils	☐ Lime Req. acid soils	☐ Other
			6.0				

SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

TEST

13. Name two forage diseases.

a. ____

b. ____

14. Name two harmful insects of forage crops.

a. ____

b. ____

15. Discuss how weeds compete with forage crops.

____

____

____

____

____

____

____

____

16. List three losses caused by weeds in forage crops.

a. ____

b. ____

c. ____

17. Match the general categories of weeds to the correct description. Write the correct numbers in the blanks.

1. Annual
2. Perennial
3. Broadleaf
4. Grass

_____a. Completes life cycle within a period of one year

_____b. Plant with longer, narrower leaves with parallel veination; monocots

_____c. Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

_____d. Plant with shorter, wider leaves that usually have pinnate or netted veination; dicots

TEST

18. List three methods of weed control.

a.____

b.____

c.____

19. Select from the following list herbicides used to control weeds in alfalfa. Write an "X" in the blank before each correct answer.

_____a. Sencor

_____b. Eptam

_____c. DDT

_____d. Methyl arsenate

_____e. Lexone

_____f. Treflan

20. Select from the following list characteristics of high quality hay. Write an "X" in the blank before each correct answer.

_____a. High in leafiness

_____b. Harvested at first bloom

_____c. Bright green color

_____d. Freedom of weeds

_____e. 15 to 20 percent moisture content

_____f. Harvested at full bloom

21. List three factors to consider in cutting alfalfa hay.

a.____

b.____

c.____

TEST

22. List four methods of processing hay.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

23. List two factors to consider in buying and selling alfalfa hay.

a. ____________________

b. ____________________

FORAGE PRODUCTION
UNIT 19

ANSWERS TO TEST

1. a. 2
   b. 7
   c. 9
   d. 13
   e. 1
   f. 4
   g. 11
   h. 5
   i. 10
   j. 12
   k. 8
   l. 3
   m. 6

2. a. Wisconsin
   b. Iowa
   c. California

3. Evaluated to satisfaction of instructor

4. a. Answer should include any two of the following

      1. Alfalfa
      2. Red clover
      3. Birdsfoot trefoil

   b. Answer should include any two of the following

      1. Smooth brome grass
      2. Orchard grass
      3. Tall fescue
      4. Intermediate wheatgrass

5. a. Leaves
   b. Stems
   c. Nodules
   d. Roots

6. a, b, c, d, e, f

7. a, d, e f

8. a, b, c, d, e, f

9. Evaluated to satisfaction of instructor

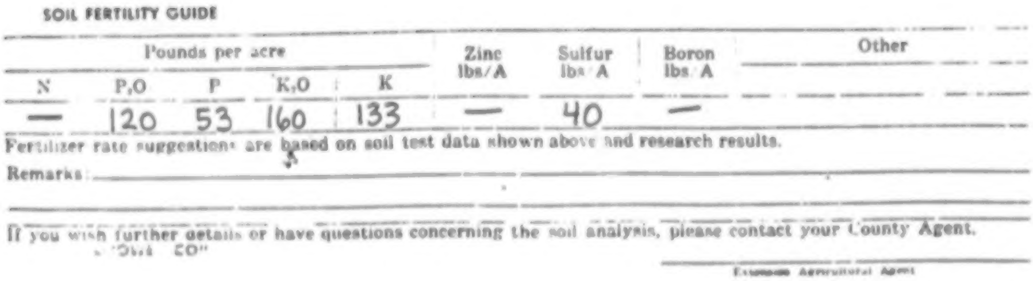
10. Evaluated to satisfaction of instructor

11. Answer should include any three of the following

    a. Peas
    b. Barley
    c. Oats
    d. Spring wheat

ANSWERS TO TEST

12.



SOIL FERTILITY GUIDE

Pounds per acre					Zinc lbs/A	Sulfur lbs/A	Boron lbs/A	Other
N	P_2O_5	P	K_2O	K				
—	120	53	160	133	—	40	—	

Fertilizer rate suggestions are based on soil test data shown above and research results.

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your County Agent.

Extension Agricultural Agent

13. Answer should include any two of the following

    a. Phytophthora root rot
    b. Bacterial wilt
    c. Verticillium wilt
    d. Spring black stem
    e. Common leaf spot
    f. Cowney mildew

14. Answer should include any two of the following

    a. Alfalfa stem nematodes
    b. Pea aphid
    c. Spotted alfalfa aphid
    d. Alfalfa weevil

15. Evaluated to satisfaction of instructor

16. Evaluated to satisfaction of instructor

17. a. 1 b. 4 c. 2 d. 3

18. a. Cultural b. Mechanical c. Chemical

19. a, b, e, f

20. a, b, c, d, e

21. Evaluated to satisfaction of instructor

ANSWERS TO TEST

22. Answer should include any four of the following

a. Baling	d. Alfalfa meal
b. Chopping	e. Haylage
c. Pelleting and wafering	f. Silage

23. Answer should include any two of the following

- a. Maturity at which hay was harvested
- b. Crude protein
- c. Dry matter

PASTURE MANAGEMENT
UNIT 20

UNIT OBJECTIVE

After completing this unit, the student should be able to discuss pasture management techniques involved with plant selection, fertilization, weed and brush control, and methods used to increase production of forage. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with pasture management to the correct definitions.
2. Name three kinds of pastures.
3. Select from a list factors to consider in selection of pasture species.
4. List three suitable grasses and legumes for pastures.
5. Select from a list advantages of a grass-legume mixture.
6. List three common grass-legume mixtures for Idaho.
7. Discuss seedbed preparation for pasture establishment.
8. List four factors to consider in planting.
9. Select from a list fertilizer needs of pastures.
10. Match methods of weed and brush control to the correct description.
11. List two advantages of renovating pastureland.
12. Select from a list methods used to increase forage production.
13. Match the grazing system for irrigated pastures to the correct description.
14. Discuss advantages of rotation grazing.
15. List three practices that reduce bloat hazard.

PASTURE MANAGEMENT
UNIT 20

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. CIS publications on forage crops and pasture; order list of available publications from: Ag Communicatins Center, Ag Publications Bldg. University of Idaho, Moscow, ID, 83843; or contact your local county extension agent.

      b. McVickar, Malcom H., Approved Practices in Pasture Management, available from: The Interstate Printers and Publishers, Inc., Danville, IL.

      c. Agricultural Experiment Station Bulletins; order list of publications from: Bulletin Mailing Office, Oregon State University, Corvallis, OR, 97331.

    2. Filmstrips, slideshows, etc.

    3. Films

  B. Make transparencies

  C. Provide students with objective sheet

  D. Provide students with information sheets

  E. Discuss unit and specific objectives

  F. Arrange field trip to survey pasture land and recommend improvement practices

SUGGESTED ACTIVITIES

G. Have students design and construct improved pasture plant board for class and local fair

H. Give test

I. Reteach if necessary

J. Retest

II. Instructional materials

A. Objectives

B. Suggested activities

C. Information sheet

D. Test

E. Answers to test

III. Unit references

A. McVickar, Malcom H., Approved Practices in Pasture Management, 3rd edition, Danville, Illinois: The Interstate Printers and Publishers, 1974.

B. Delorit, R.J., et al. Crop Production, 4th edition, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

C. Ensign, R.D. Rejuvenating Old Pastures. University of Idaho, Current Information Series No. 409. Moscow, ID: 1977.

D. Painter, C.G., et al. Idaho Fertilizer Guide: Irrigate Pastures, Southern Idaho. University of Idaho, Current Information Series No. 392. Moscow, ID: 1977.

E. Ensign, R.D., et al. Idaho Forage Crop Handbook. University of Idaho, Current Information Series No. 547. Moscow, ID: 1975.

F. Heath, M.E., Barnes, R.F., and Metcalf, D.S. Forages: The Science of Grassland Agriculture. (1985) 4th edition. Iowa State University Press. Ames, Iowa.

PASTURE MANAGEMENT
UNIT 20

INFORMATION SHEET

I. Terms and definitions

A. Improved pasture--Fenced area of domesticated forages, usually improved, on which animals are grazed

B. Native pasture--A forage area covered by native plants and grazed by livestock

C. Rotation grazing--The grazing of 4 or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse

D. Continuous grazing--The grazing of a specific pasture throughout the year

E. Annual--A plant which germinates and completes its life cycle in one year

F. Perennial--A plant that lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

G. Erosion--Loss of soil by the actions of tillage, wind, and/or water

H. Renovating--Practice of loosening the soil to allow freer movement of water and air and to control weeds

I. Native grass--Grass species indigenous to an area, not introduced

II. Kinds of pastures

A. Native pastures

(Note: Grasslands of this type consist of native types of forage plants. Drier areas have more shrubs and fewer grasses. In general, the grazing capacity is much lower than that of pastures in humid areas. In the U.S., grazing land of this type is referred to as rangeland.)

B. Long-term pastures

(Note: These pastures consist of introduced perennial grasses and legumes, self-seeding annuals, or of both. Normally not plowed for five years or more.)

C. Rotation pastures

(Note: These pastures are used for grazing in regular order with cultivated and harvested crops. Usually the period of grazing extends from one to three years.)

INFORMATION SHEET

D. Annual pastures

(Note: These pastures are seeded to annual forage plants.)

E. Temporary pastures

(Note: Fields used for grazing when other pastures become unproductive. They may be annual pastures or they may represent the aftermath of hay fields or small grain stubble.)

III. Factors to consider in selection of pasture species

A. Use intended--Cattle, sheep, horses

B. Hardiness

C. Adaptability

D. Compatibility of species mix

E. Nutritional qualities

F. Palatability

G. Soil building capabilities

H. Life span

I. Establishment ease

J. Drought tolerance or moisture requirement

IV. Major forage species

Table 1--Legumes

Species	Growth Habit	Palatability	Optimum Moisture Requirement
1. Alfalfa	Tap to rhizomatous	Moderate	16-25+
2. Alsike clover	Stoloniferous	High	25+
3. White clover	Stoloniferous	High	18-25+
4. Red clover	Non-spreading	Medium	20-25+
5. Sainfoin	Non-spreading	High	14-22+
6. Strawberry clover	Stoloniferous	High	25+
7. Sweet clover	Non-spreading	Low	15-20+
8. Birdsfoot Trefoil	Non-spreading	High	20-25+

INFORMATION SHEET

Table 2--Grasses

Species	Growth Habit	Palatability	Optimum Moisture Requirement
1. Kentucky Bluegrass	Rhizomatous	High	18-25+
2. Smooth brome	Rhizomatous	High	16-22+
3. Crested wheatgrass	Bunch	Medium	10-16
4. Siberian wheatgrass	Bunch	Medium	8-14
5. Inter. wheatgrass	Sod	High	14-22+
6. Orchardgrass	Bunch	Med. High	20-25+
7. Reed canarygrass	Rhizomatous	Med. High	25+
8. Tall fescue	Bunch	Medium	18-22+
9. Tall wheatgrass	Bunch	Low	15-22

V. Advantages of grass-legume mixtures

A. Control soil erosion

B. Improved soil fertility

C. Reduce invasion by weeds

D. Less bloat hazard than straight legume

E. Produce more and higher quality forage than straight grass

(Note: Feeding trials have shown that grass-legume mixtures are equally as nutritious and are as productive of livestock products as are legumes seeded alone. Forage yields of grass-legume mixtures under irrigation are generally equal to those of the legume seeded along.)

F. Improved palatability

INFORMATION SHEET

VI. Grass-legume mixtures for Idaho

A. Alfalfa and orchardgrass

B. Alfalfa and smooth bromegrass

C. Alfalfa and tall fescue

D. Birdsfoot trefoil and orchardgrass

E. Birdsfoot trefoil and reed canarygrass

F. White clover and Kentucky bluegrass

G. Sainfoin and orchardgrass

H. Alsike clover and meadow foxtail

(Note: Refer to Idaho Forage Crop Handbook for more information on adaptability of mixtures to soil type, mositure requirements and seeding rates or contact your local county extension agent for mixtures adapted to your local area.)

VII. Seedbed preparation

A. Remove trees and/or shrubs

B. Plow soil if weeds are a problem

C. Use disc if soil is loose and not infested with weeds

D. Use harrow or drag and level land

E. Use roller to firm soil

(Note: A firm, weed-free seedbed is of primary importance in the successful establishment of small-seeded grasses and legumes. A firm seedbed holds moisture near the surface, helps control depth of seeding and provides ready anchorage for the tiny seedling roots. The soil surrounding the seeds after seeding should be moist to promote rapid germination, emergence and successful establishment.)

INFORMATION SHEET

VIII. Factors to consider in planting

A. Use certified seed

B. Inoculate all legume seeds with proper rhizobia just prior to seeding

C. Depth of planting

1. Clayey soils--1/2 inch

2. Loamy soils--1 inch

3. Sandy soils--1 1/2 inch

(Note: When mixtures are sown, the depth of seeding should be regulated to favor the small-seeded species.)

D. Rowspacing--Six or seven inches

(Note: Plant all seeding with a drill equipped with depth regulators. Drills distribute the seed more uniformly and assure proper soil coverage to increase the possibility of successful stand establishment. Many grass seeds are light and chaffy and will not feed through the drill evenly. This can be prevented by mixing the grass seed for each acre with enough rice or pea hulls to make one bushel. This mixture will feed readily through the drill to give uniform distribution of seed.)

E. Time of seeding

1. Spring seeding--Generally recommended for all areas of Idaho.

(Note: In southern Idaho irrigated areas with a long growing season, seeding may be done as late as August 15. This allows the seedlings to become well established before fall freeze-up and results in minimum winter-killing.)

2. Late fall seeding--Recommended where average rainfall is less than 12" annually.

(Note: Sow seed early enough so it will produce a good healthy seedling before soil freezes.)

INFORMATION SHEET

F. Rate of seeding

(Note: Rate of seeding will vary for straight legume, straight grass, or a mixture of the two. Consult the Idaho Forage Crop Handbook for recommended seeding rates or your local county extension agent.)

IX. Fertilizer needs of established pasture

(Note: Should check soil pH before seeding and if low should lime accordingly.)

A. Nitrogen (N)

(Note: Established grass pastures have responded well to nitrogen application up to 150 lb./acre. As the amount of legume increases in a pasture, the need for nitrogen fertilizer decreases. On pastures containing a high percentage of legumes, nitrogen applications will reduce the quantity of legume in the forage.)

B. Phosphorus (P)

(Note: Intensively managed and high producing pastures respond to phosphorus applications. Phosphorus can best be applied during seedbed preparation. Established pastures may be top-dressed with phosphorus preferably in the fall.)

C. Potassium (K)

(Note: Potassium should be incorporated during seedbed preparation or broadcast in the fall.)

D. Sulphur (S)

(Note: Sulphur demand is higher for legume plants than grasses. Areas irrigated with Snake River water should not experience a shortage of sulphur.)

X. Methods of weed and brush control

A. Chemical--Removing by applying a selective herbicide

B. Mechanical--Removing by some type of mechanical practice such as mowing, plowing under, or burning

XI. Advantages of renovating pasture land

A. Reduces competition of other plants

B. Provides for more available nutrients

C. Increases movement of air and water

INFORMATION SHEET

XII. Methods used to increase forage production

A. Correct soil problems before attempting to establish an improved pasture

(Note: Problems such as land leveling, installation of drainage systems, and compacted soils are easier to deal with before the pasture is seeded. Consult your extension agricultural agent or district Soil Conservation Service personnel for soil information for your area.)

B. Control soil pests

(Note: Frequently, old pastures have wireworms, sod webworms and other soil inhabiting pests which are destructive to pasture plants. If you suspect that pests exist in your pasture area, consult your Extension Agricultural agent for control recommendations.)

C. Select and plant improved pasture species

(Note: The proper species depends upon the kinds of grazing animals, area of the state, soil factors and moisture availability.)

D. Fertilize regularly

E. Control weeds and brush

F. Protect from overgrazing by pasture rotation

(Note: A good rotation grazing system is necessary to maintain young, productive and nutritive vegetation and to maximize carrying capacity over the entire grazing season.)

XIII. Grazing systems for irrigated pastures

A. Continuous--The grazing of a specific pasture continuously throughout the year

(Note: Grazing a pasture continuously results in reduced yields, weed invasion and the eventual loss of the more productive forage plants.)

B. Rotational--The grazing of 4 or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse

(Note: Compared to continuous grazing, rotation grazing increases the productivity of most forage species and thus increases farm income from forage production.)

C. Strip--Confining animals to a strip area of forage to be consumed in a short period of time; the livestock are moved to a new pasture each day; electric fences often used

INFORMATION SHEET

XIV. Advantages of rotation grazing

A. Proper rotation grazing promotes vigorous plant regrowth and uniform forage utilization

B. The forage can be maintained in a relatively young, rapidly growing and nutritious state

C. High-yielding forage species which are susceptible to overgrazing and trampling damage can be successfully maintained

D. One of the best means to efficiently use forage

XV. Reducing bloat hazard

A. Seed a grass-legume mixture

(Note: Keep the legume component in the pasture mix under 50 percent.)

B. Keep grasses and legumes in proper balance with an adequate fertilization program

C. Have salt and water available at all times

D. Do not graze the animals early in the spring when there is a rapid change from cool to warm growing temperatures.

(Note: Under these conditions, legumes often make a sudden flush and outgrow the grass.)

E. Do not graze wet foliage

F. Condition animals to fresh green forage

(Note: Put livestock in a few hours at first, and provide dry hay for the livestock to eat.)

G. Watch animals closely for early symptoms

PASTURE MANAGEMENT
UNIT 20

TEST

NAME_______________________________________ SCORE______________

1. Match terms associated with pasture management to the correct definitions. Write the correct numbers in the blanks.

1. Improved pasture
2. Native pasture
3. Rotation grazing
4. Continuous grazing
5. Annual
6. Perennial
7. Erosion
8. Renovating
9. Native grass

_____a. A plant which germinates and completes its life cycle in one year

_____b. The grazing of 4 or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse

_____c. Practice of loosening the soil to allow freer movement of water and air and to control weeds

_____d. A forage area covered by native plants and grazed by livestock

_____e. Grass species indigenous to an area, not introduced

_____f. Fenced area of domesticated forages, usually improved, on which animals are grazed

_____g. Loss of soil by the actions of tillage, wind, and/or water

_____h. A plant that lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

_____i. The grazing of a specific pasture throughout the year

2. Name three kinds of pastures.

a.____

b.____

c.____

TEST

3. Select from the following list factors to consider in selection of pasture species. Write an "X" in the blank before each correct answer.

_____a. Compatibility of species mix

_____b. Life span of species

_____c. Drought tolerance or moisture requirement

_____d. Nutritional qualities

_____e. Winter hardiness

_____f. Palatability

_____g. Intended use of pasture

_____h. Ease of establishment

4. List three suitable grasses and legumes for pastures.

A. Legumes

1. ____________________

2. ____________________

3. ____________________

B. Grasses

1. ____________________

2. ____________________

3. ____________________

5. Select from the following list advantages of grass-legume mixtures. Write an "X" in the blank before each correct answer.

_____a. Improves fertility of the soil

_____b. Produces lower quality forage than straight grass

_____c. Produces more forage than straight grass

_____d. More bloat hazard than straight legume

_____e. Better control of soil erosion than straight legume

_____f. Less bloat hazard than straight grass

TEST

6. List three common grass-legume mixtures for Idaho.

a.____

b.____

c.____

7. Discuss seedbed preparation for pasture establishment.

8. List four factors to consider in planting.

a.____

b.____

c.____

d.____

9. Select from the following list fertilizer needs of pastures.
Write an "X" in the blank before each correct answer.

_____a. Magnesium (Mg)

_____b. Calcium (Ca)

_____c. Sulphur (S)

_____d. Potassium (K)

_____e. Phosphorus (P)

_____f. Nitrogen (N)

TEST

10. Match the methods of weed and brush control to the correct description. Write the correct numbers in the blanks.

    1. Chemical
    2. Mechanical

    _____a. Removing by applying a selective herbicide

    _____b. Removing by using practices such as mowing, plowing under, or burning

11. List two advantages of renovating pasture land.

    a.____

    b.____

12. Select from the following list methods used to increase forage production. Write an "X" in the blank before each correct answer.

    _____a. Protect pasture form overgrazing

    _____b. Select proper pasture species for your conditions

    _____c. Regular addition of fertilizers

    _____d. Elimination of competition from weeds and brush

    _____e. Using a rotation grazing system

    _____f. Correction of soil problems prior to seeding of pasture

13. Match the grazing systems for irrigated pastures to the correct description. Write the correct numbers in the blanks.

    1. Continuous
    2. Rotational
    3. Strip

    _____a. The grazing of 4 or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse

    _____b. The grazing of a specific pasture continuously throughout the year

    _____c. Confining animals to an area of forage to be consumed in a short period of time; the livestock are moved to a new pasture each day

TEST

14. Discuss advantages of rotation grazing.

15. List three practices that reduce bloat hazard.

a.

b.

c.

PASTURE MANAGEMENT
UNIT 20

ANSWERS TO TEST

1. a. 5
   b. 3
   c. 8
   d. 2
   e. 9
   f. 1
   g. 7
   h. 6
   i. 4

2. Answer should include any three of the following

   a. Native pastures
   b. Long-term pastures
   c. Rotation pastures
   d. Annual pastures
   e. Temporary pastures

3. a, b, c, d, e, f, g, h

4. Evaluated to satisfaction of instructor

5. a, c, e

6. Evaluated to satisfaction of instructor

7. Evaluated to satisfaction of instructor

8. Answer should include any four of the following

   a. Use of certified seed
   b. Inoculation of legume seeds with proper rhizobia prior to seeding
   c. Depth of planting
   d. Rowspacing
   e. Time of seeding
   f. Rate of seeding

9. c, d, e, f

10. a. 1 b. 2

11. Answer should include any two of the following

    a. Reduces competition of other plants
    b. Provides for more available nutrients
    c. Increases movement of air and water

12. a, b, c, d, e, f

13. a. 2 b. 1 c. 3

14. Evaluated to satisfaction of instructor

15. Evaluated to satisfaction of instructor

RANGELAND MANAGEMENT
UNIT 21

UNIT OBJECTIVE

After completion of this unit, the student should be able to match terms with the correct definitions. The student should also be able to discuss rangeland management techniques involved with plant selection and grazing of livestock. The student should also be able to make recommendations for imporvement of existing rangeland. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with rangeland management to the correct definitions.
2. List three uses of rangeland.
3. Give the percentage of rangeland in the world, United States and Idaho.
4. List four kinds of plants found on range sites.
5. List three classifications of range plants other than by structure.
6. Select from a list characteristics of a good rangeland plant.
7. Classify grasses as very palatable, palatable, or less palatable.
8. Select from a list factors affecting forage growth.
9. Match the periods of plant growth on western ranges to the correct definitions.
10. List four factors to consider in planning grazing.
11. Discuss what a grazing plan should include.
12. List three general and two specific objectives of a grazing system.
13. Match grazing systems to the correct descriptions.
14. List three classes of plant response to range disturbance.
15. Match range conditions to the correct descriptions.

OBJECTIVE SHEET

16. Select from a list benefits received from range improvement practices.
17. List five range improvement practices.
18. Arrange in order the steps in the range improvement process.
19. List two methods to prevent overgrazing.
20. List three methods of weed and brush control.
21. Discuss the control of undesirable animals.
22. Calculate animal units.
23. Discuss the determination of stocking rate.
24. List three classes of range utilization.
25. List three agencies involved in rangeland management.
26. List two significant legislative acts to rangeland management.

RANGELAND MANAGEMENT
UNIT 21

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit

      1. Literature

         a. Several publications available from Oregon State University. For a catalog of publications, write to: Bulletin Mailing Office, Industrial Building, Oregon State University, Corvallis, OR 97331.

         b. Several publications available form the University of Idaho. For a catalog of publications, write to: Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, ID 83843.

      2. Filmstrips, slideshows, etc.

      3. Films

   B. Make transparencies

   C. Provide students with objective sheet

   D. Provide students with information sheet

   E. Discuss unit and specific objectives

   F. Discuss information and assignment sheets

   G. Do a community survey on rangeland use and publish results in local newspaper

   H. Highlight the areas of rangeland use on a world, U.S. and Idaho map

   I. Conduct a range bowl

   J. Invite a person from BLM or Forest Service to address the class on public lands

   K. Invite early settler of your area to address the early use of rangeland

SUGGESTED ACTIVITIES

L. Encourage students to read books about the history of the west and its ranges, and to summarize the range and/or livestock conflicts that took place

M. Invite Fish and Game expert to address competition between livestock and wildlife on the range, and multiple use resource management

N. Give test

O. Reteach if necessary

P. Retest

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Uses of rangeland
2. TM 2--Land use - USA
3. TM 3--Potential vegetation of Idaho
4. TM 4--Important range plant groups
5. TM 5--Grass plant
6. TM 6--Winter annuals
7. TM 7--Summer annuals
8. TM 8--Biennials
9. TM 9--Perennials
10. TM 10--Palatability of grasses
11. TM 11--Vegetative retrogression of plant species based on their response to disturbance such as overgrazing
12. TM 12--Mechanical methods of control
13. TM 13--Mechanical methods of control

SUGGESTED ACTIVITIES

14. TM 14--Chemical control

15. TM 15--Chemical control

16. TM 16--Animal unit equivalents

E. Test

F. Answers to assignment sheets

III. Unit references

A. Hannebaum, J. Source Unit in Range and Pasture Management. Colorado State University. Department of Vo-Ed. Agriculture Education Division. 1975.

B. Improving Native Rangeland: Unit II. Stillwater, OK. State Department of Vocational and Technical Educaiton. Curriuculum and Instructional Materials Center.

C. Crops, Soils and Fertilizers Resource Manual. Moscow, ID. University of Idaho. Vo-Ed No. 73. 1978.

D. Stevens, Larry W. Notes from range curriculum taught at Grace High School. Grace, ID.

E. Beitia, Marc. Notes from range curriculum taught at Raft River High School. Malta, ID.

F. Resource Unit on Range Management for Core Curriculum. Bozeman, Montana. Montana State University. Agricultural and Industrial Education. 1976.

G. Sharp, L.A. and Sanders, K.D. Rangeland Resources of Idaho. Idaho Rangeland Comm. and College of FWR. University of Idaho, Moscow, ID. 1978.

RANGELAND MANAGEMENT
UNIT 21

INFORMATION SHEET

I. Terms and definitions

A. Range--Land not suited for cultivation, which supports a cover of vegetation suitable for grazing by animals

B. Native plant--Plant originating in North America

C. Introduced plant--Plant brought from countries outside the United States

D. Climax--The thrifty productive grasses that comprise a high percentage of the grass cover of a range in top condition; these decrease under heavy use

E. Grass--Any plant of the family Gramineae; characteristic of long narrow leaves with parallel veination

F. Grass-like--Resembling grasses; usually used for sedges and rushes

G. Forb--A plant with a solid, non-woody stem, usually broadleaf with netted veination

H. Shrub--A woody perennial plant with a solid woody stem which is characteristic of growth rings

I. Palatability--The degree of an animal's desire to graze or not to graze a certain plant

J. Decreasers--Plant that decreases on a range when exposed to heavy grazing pressures

K. Increasers--Plant that increases on a range when decreasers are reduced

L. Invader--Plant which comes into a range after both increasers and decreasers have been reduced

M. Forage value--Rating of a plant as a feed for cattle or sheep; a species will be classified as high, medium or low

N. Warm-season plant--Plant which grows during the summer and early fall

O. Cool-season plant--Plant which grows during the fall, winter, or spring

P. Range condition--The current productivity of a range relative to what that range is naturally capable of producing

INFORMATION SHEET

Q. Range trend--The direction of change in range condition

(Note: If the change is toward the climax, the range is improving and the trend is up. If the change is away from the climax, the range is deteriorating and the trend is down.)

R. Range utilization--Amount of forage removed from a range area by grazing animals

S. Animal unit--One mature cow or the equivalent based upon average daily forage consumption of 12 kg. dry matter per day

T. Animal unit month (AUM)--The amount of feed or forage required by an animal unit for one month

U. Range management--The care and use of rangeland for multiple uses including the highest continuous yield of animal products without endangering soil and water resources

V. Range improvement--Special treatments, developments, and structures used to improve range forage resources or to facilitate their use by grazing animals

W. Stocking rate--Number of animal units that are grazed in a certain area for a certain period of time

X. Grazing plan--A plan for grazing rangeland based upon the range condition and types of vegetation

II. Uses of rangeland

A. Livestock production

1. Cattle grazing

2. Sheep grazing

B. Watershed

C. Wildlife

D. Recreation

E. Energy reserves

1. Coal

2. Oil

3. Natural gas

INFORMATION SHEET

III. Amount of rangeland

  A. Worldwide

    1. Approximately 47% of the earths surface can be classified as rangeland

    (Note: Figures quote 30% of earths surface as rangeland, but forest and desert rangelands are not included in this figure.)

  B. United States

    1. Approximately 47% of the U.S. is classified as rangeland, not including forest and desert

    (Note: Of the 1.9 billion acres in the U.S., 885 million are classified as rangeland.)

  C. Idaho

    1. Approximately 85% of the land in Idaho is rangeland

    (Note: About one-half of this land is forested.)

IV. Kinds of plants found on range sites

  A. Grasses

  B. Grass-like

  C. Forbs

  D. Shrubs

V. Classification of range plants (other than by structure)

  A. Life span

    1. Annual

    2. Biennial

    3. Perennial

  B. Origin

    1. Native

    2. Introduced

INFORMATION SHEET

- C. Growth season
    - 1. Cool season
    - 2. Warm season

VI. Characteristics of a good rangeland plant

- A. Hardiness
- B. Good nutritional qualities
- C. Good palatability
- D. Soil building/holding
- E. Drought tolerant
- F. Easy to establish

VII. Palatability of grasses

(Note: Palatability will vary depending on associated plant species and type of grazing animal.)

- A. Very palatable
    - 1. Bluebunch wheatgrass
    - 2. Idaho fescue
    - 3. Orchard grass
- B. Palatable
    - 1. Crested wheatgrass
    - 2. Kentucky bluegrass
    - 3. Junegrass
- C. Less palatable
    - 1. Cheatgrass
    - 2. Medusahead
    - 3. Three awn

INFORMATION SHEET

VIII. Factors affecting forage growth

A. Rainfall

(Note: Moisture is the most limiting resource in the development of rangelands.)

B. Sunlight

C. Temperature

D. Nutrients in the soil

E. Texture of soil

F. Structure of soil

G. Topography

IX. Periods of plant growth on western ranges

A. Period 1--Initial growth, usually in spring. Soils are damp and cold. Growth is slow and leaves contain much moisture. New leaves are high in crude protein, minerals, and energy, but cattle cannot usually get enough new growth to satisfy their intake needs. Plant growth is less than animal demand unless stocking pressures are very low. This period is before traditional range readiness

B. Period 2--Plant growth is just about even with animal demand. This is usually a short time at most. Nutritional values are just about adequate to meet requirements

C. Period 3--This is the flush period where animal demand is usually less, sometimes greatly so, than the forage supply. Nutrition is high, animals gain well during the entire period but less well as the end arrives

D. Period 4--Dormant period. This will certainly be the dry season and may be during the wet season, also. There may or may not be a late summer-fall green-up which is a short time repeat of Period 1 but not of Period 2 and 3. Period 4 will be the longest period of the year. During this period, nutritional values may limit animal performance

X. Factors to consider in planning grazing

A. Intensity of use--How many animals there are for a given area

B. Frequency of use--How often grazing is done

C. Season of use--When grazing occurs in a plant's life history

D. Selectivity of use--What plants are being eaten

INFORMATION SHEET

XI. A grazing plan should include

   A. The time when the range is ready to graze (depending upon plant growth)

   B. The season during which the range can be used for the greatest benefit from the vegetation and offer the greatest protection of improvement of the range

   (Note: Move livestock in relation to plant growth stage and forage utilization, not by calendar. Be sure enough forage is available in the next pasture or another move will be imminent.)

XII. Objectives of a grazing system

   A. General

      1. Increase forage production

      2. Increase wildlife

      3. Minimize soil erosion

      4. Minimize recreational conflicts

   B. Specific

      1. Vegetation

         a. Maintenance or improvement of range condition

         b. Restore vigor to plants

         c. Allow for reproduction of plants (vegetative and sexual)

      2. Animal

         a. Provide more nutritional forage

         b. Maintain or increase current levels of production

XIII. Grazing systems

   A. Deferred--A range is not grazed until seed maturity is assured, or a comparable growth stage

   B. Rested--A range is not grazed for the entire year

   C. Ungrazed--Range receiving a period of no grazing which is not rested or deferred

D. Continuous--The grazing of a range continuously throughout the year

E. Repeated seasonal--Grazing the range the same time each year

F. Rotational--Moving livestock from one area of range to another on a scheduled basis

XIV. Classes of plant response to range disturbance

A. Decreaser

(Note: This is a plant that is reduced in numbers or composition as a result of heavy grazing.)

B. Increaser

(Note: This is a plant that increases in percentage of composition during the first part of heavy grazing as the range condition is on the decline. Continued heavy grazing will cause these plants to decrease in composition.)

C. Invader

(Note: This is a plant not present under an ideal climax condition or only present in small amounts. These plants increase in composition on extremely heavy grazed range or one that is deteriorating.)

XV. Range condition

(Note: This corresponds to the Soil Conservation Service rating system.)

A. Excellent--76 to 100 percent of the vegetation is a mixture of highly palatable and desirable plants

B. Good--51 to 75 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants

C. Fair--26 to 50 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants

D. Poor--Less than 25 percent of all vegetation consists of highly palatable and desirable plants

INFORMATION SHEET

XVI. Benefits received from range improvement practices

A. Increased quantity of forage

B. Increased quality of forage

C. Increased animal production

(Note: Increased animal production would include both domestic livestock and wildlife.)

D. Control of livestock poisoning by poisonous plants

E. Reduced fire hazard

F. Increased water yields on watershed

G. Controlling erosion by stabilizing erosive soils

H. Reduce conflicts between multiple uses of range resources

(Note: Controlled burning can be a useful improvement tool in special situations. Annual burning is not recommended. The application of fertilizer has definitely shown an increased tonnage, but there is a question as to whether it is economical.)

XVII. Range improvement practices

A. Adequate and well placed water supplies

B. Fenced to control grazing

C. Salt licks located at each watering hole

D. Management of native forage

E. Seeding of range

F. Practice weed and brush control

G. Rodent and insect control

H. Burning

I. Range fertilization

J. Develop and implement grazing plan

INFORMATION SHEET

XVIII. Steps in range improvement process

A. Identify cause of poor performance by range

1. Overgrazing--Livestock, wildlife, or both

2. Fire

3. Insects

4. Drought

5. Shrub invasion not related to past or current animal use

B. Select range improvement practices best suited for the situation

C. Implement selected range improvement practices

D. Maintain proper range management practices and evaluate effect of improvement practices

(Note: Overgrazing will destroy the root supply, decrease the food supply available for new growth the following year, pack the ground, and reduce water intake.)

XIX. Prevention of overgrazing

A. Rotate pastures

B. Graze lightly during seed production seasons

C. Regulate animal units

(Note: When cattle graze, the first parts of the plant they remove are the stem and the bud. This causes lateral branching which produces new growth. It is recommended that 50 percent of a plant by weight be removed and 50 percent left because heavily grazed plants lose vigor and die. Using herbicides is the most selective and most economical method, while mechanical clearing is the most expensive method and must be used on land where erosion is not a problem.)

INFORMATION SHEET

XX. Weed and brush control

- A. Mechanical
    1. Root plowing
    2. Cutting brush
    3. Bulldozing
    4. Chaining and cabling
    5. Mowing and shredding
    6. Girdling
    7. Heavy-duty brush cutters
- B. Burning

    (Note: Burning alone will not control undesirable woody plants. Practices such as seeding to grass, rotation of grazing ranges, and careful grazing practices will help prevent the return of undesirable shrubs. Generally, the burning of rangeland is considered ineffective due to a lack of sufficient ground cover to burn both large and small plants. Fire along with a combination of mechanical control methods is considered a more positive means of controlling woody plants than when using fire alone.)
- C. Chemical
    1. Aerial spraying
    2. Basal trunk spraying
    3. Ground application--Granules, pellets, balls
    4. Stump treatment

XXI. Control of undesirable animals

- A. Predators (coyote, etc.)
    1. Trapping
    2. Shooting
    3. Poisoning
- B. Rodents (ground squirrels, gophers, etc.)
    1. Trapping
    2. Poisoning

INFORMATION SHEET

XXII. Animal unit--Equivalent to a 1000 pound cow and calf which will consume approximately 26 pounds of dry forage per day

(Note: The forage required for one animal unit for one month is an animal unit month (AUM). Stocking rate figures are expressed as animal unit months per acre.)

Animal Unit Equivalents

1 cow =1.0 A.U.
1 yearling =0.6 A.U.
1 bull =1.3 A.U.
1 horse =1.5 A.U.
5 ewes =1.0 A.U.
5 deer =1.0 A.U.
10 antelope =1.0 A.U.
1 elk =0.8 A.U.
160 ground squirrels =1.0 A.U.

XXIII. Determining stocking rate

A. Determine the number of usable acres in the pasture by subtracting the rocky, wooded, and other unusable acres from the total acres. This results in the total usable acres

B. Find the animal unit stocking rate for the range by multiplying the animal unit month figure by the number of usable acres

C. Find the stocking rate for a growing season by dividing the length of the grazing season in months into the total animal unit months stocking rate

(Note: Another method of determining the stocking rate is to graze the animals on the pasture and observe the effect upon the vegetation, and make animal number adjustments according to the reaction of the vegetation. This method requires more experience and time but is the most accurate. Stocking rates will vary from pasture to pasture.)

XXIV. Classes of range utilization

A. Heavy use

B. Moderate use

C. Light use

(Note: It is important to know range utilization so that the range vegetation can be used efficiently without damaging the productivity of the range.)

INFORMATION SHEET

XXV. Agencies involved in rangeland management

A. Bureau of Land Management

B. U.S. Forest Service

C. Agricultural Stabilization and Conservation Service

D. Soil Conservation Service

E. Cooperative Extension Service

F. State Department of Lands

G. Bureau of Indian Affairs

XXVI. Significant legislative acts to rangeland management

A. Homestead Act--1862

B. Timber Culture Act--1873

C. Forest Reserve Act--1901

D. Enlarged Homestead Act--1916

E. Stock Grazing Homestead Act--1916

F. Soil Erosion Service--1933

G. Taylor Grazing Act--1934

H. Halogeton Control Act--1952

I. Forest and Rangeland Renewable Resources Planning Act--1974

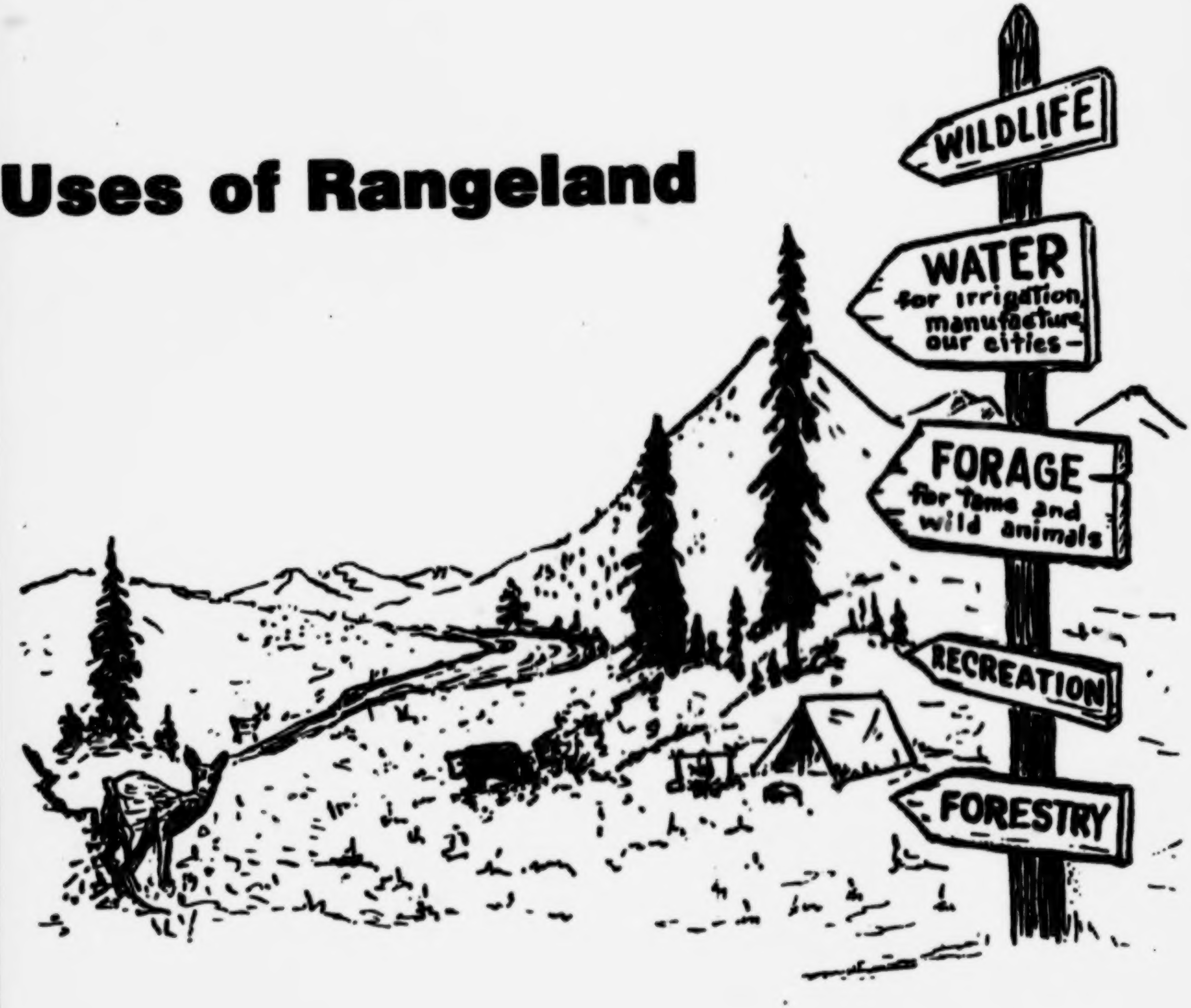
J. Federal Lands Policy and Management Act--1976

K. Desert Land Act--1977

L. Grazing Fee Study--1977 and 1985

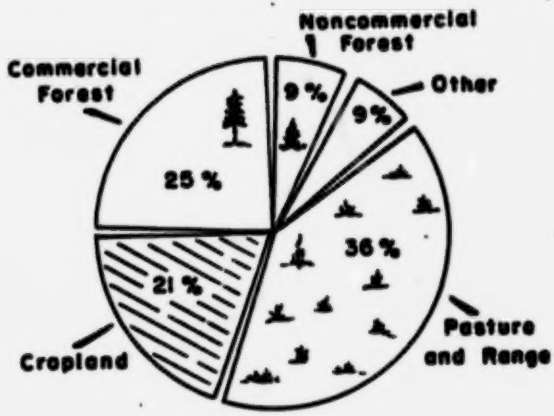
M. Public Rangelands Improvement Act--1978

Uses of Rangeland


WILDLIFE
WATER
for irrigation, manufacture our cities
FORAGE
for tame and wild animals
RECREATION
FORESTRY

CSS 21 19

Land Use - USA



TM #2

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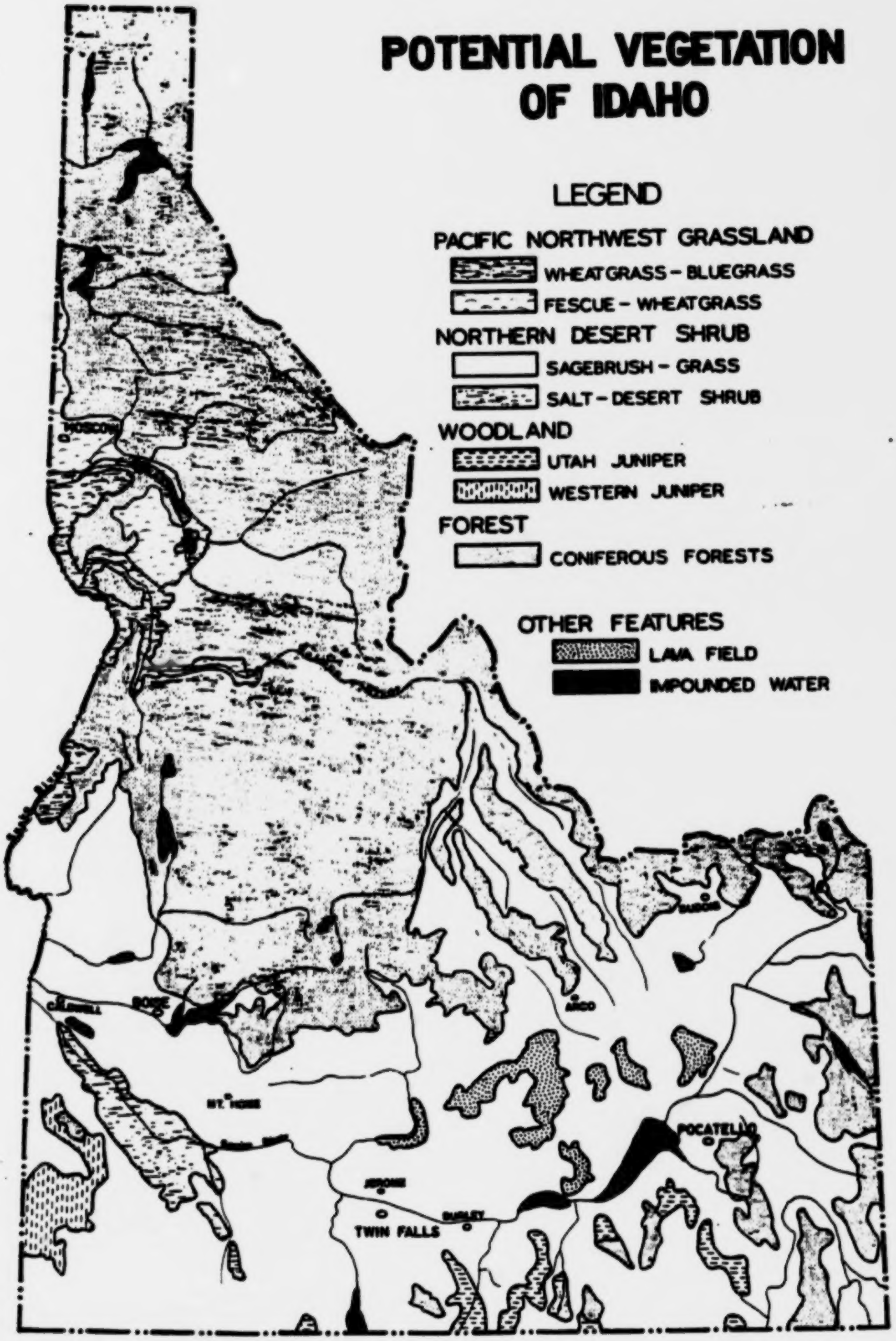
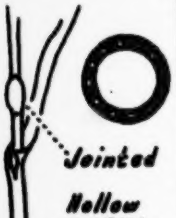
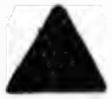
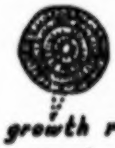
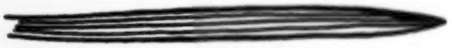
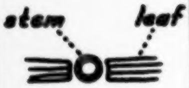
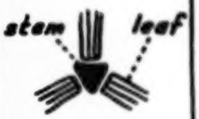
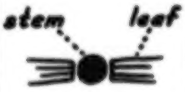
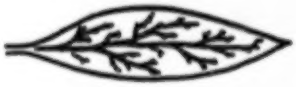
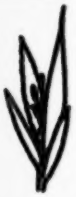
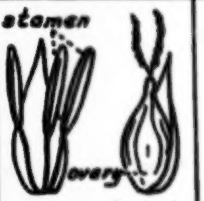
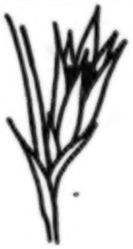
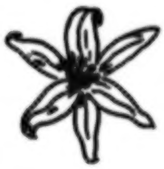
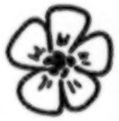
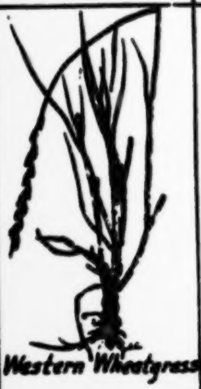
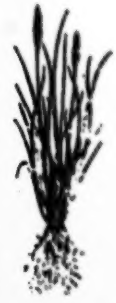
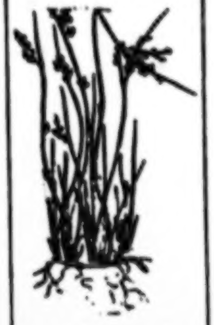
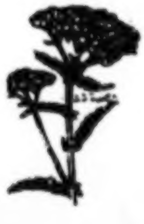
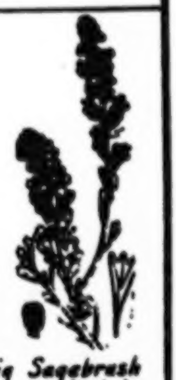


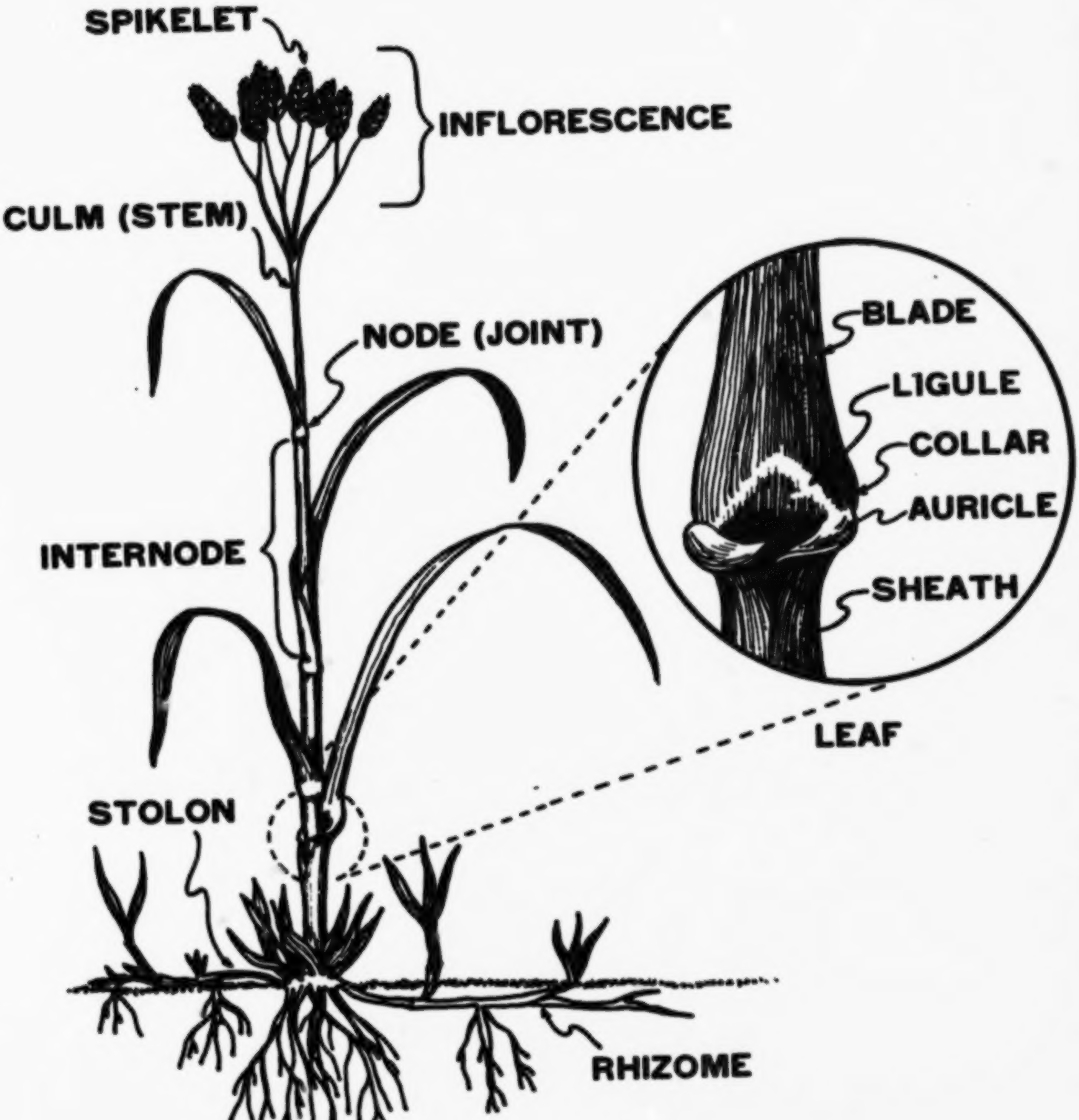
POTENTIAL VEGETATION OF IDAHO

LEGEND
PACIFIC NORTHWEST GRASSLAND
WHEATGRASS - BLUEGRASS
FESCUE - WHEATGRASS
NORTHERN DESERT SHRUB
SAGEBRUSH - GRASS
SALT - DESERT SHRUB
WOODLAND
UTAH JUNIPER
WESTERN JUNIPER
FOREST
CONIFEROUS FORESTS
OTHER FEATURES
LAVA FIELD
IMPOUNDED WATER
MOSCOW
SALMON
ARCO
CALDWELL
BOISE
MT. HOME
POCATELLO
JEROME
BURLEY
TWIN FALLS

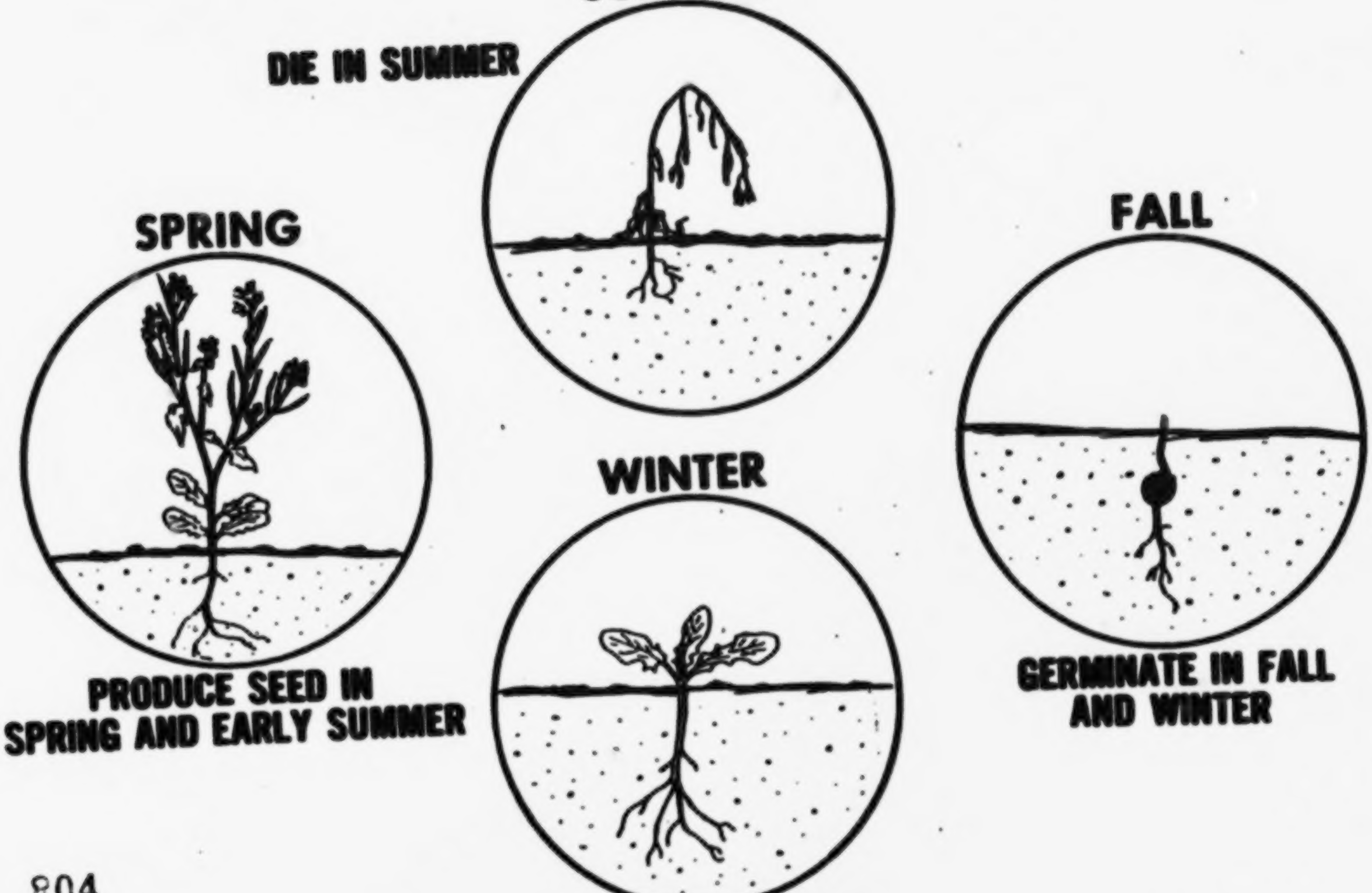
IMPORTANT RANGE PLANT GROUPS

	GRASSES	GRASSLIKE Sedges	 Rushes	FORBS	SHRUBS (Browse)
STEMS	 Hollow or Pithy	 Solid Not Jointed		 Solid	 growth rings Woody Solid
LEAVES	 Parallel Veins  Leaves on 2 sides of stem	 Leaves on 3 sides of stem	 Leaves on 2 sides of stem; rounded	 "Veins" are usually netlike	
FLOWERS	 (floret)	 stamen ovary male female (may be combined)		 Often showy	
EXAMPLE	 Western Wheatgrass	 Threadleaf Sedge	 Wire Rush	 Western Yarrow	 Big Sagebrush (twig)

GRASS PLANT


SPIKELET
INFLORESCENCE
CULM (STEM)
NODE (JOINT)
INTERNODE
BLADE
LIGULE
COLLAR
AURICLE
SHEATH
LEAF
STOLON
RHIZOME

WINTER ANNUALS



SUMMER

DIE IN SUMMER

SPRING

PRODUCE SEED IN
SPRING AND EARLY SUMMER

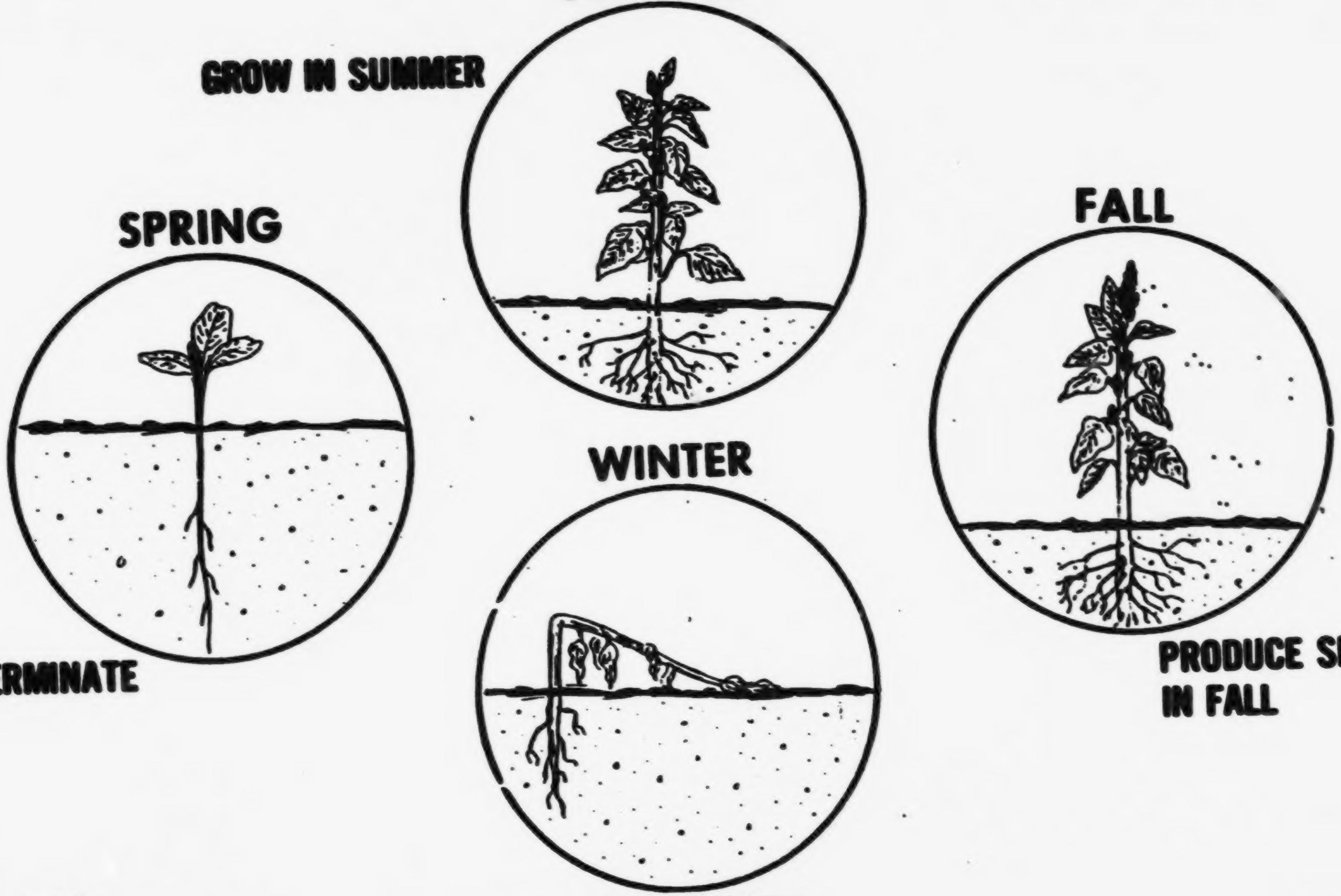
FALL

GERMINATE IN FALL
AND WINTER

WINTER

DORMANT IN WINTER

SUMMER ANNUALS



SUMMER

GROW IN SUMMER

SPRING

GERMINATE

FALL

PRODUCE SEED IN FALL

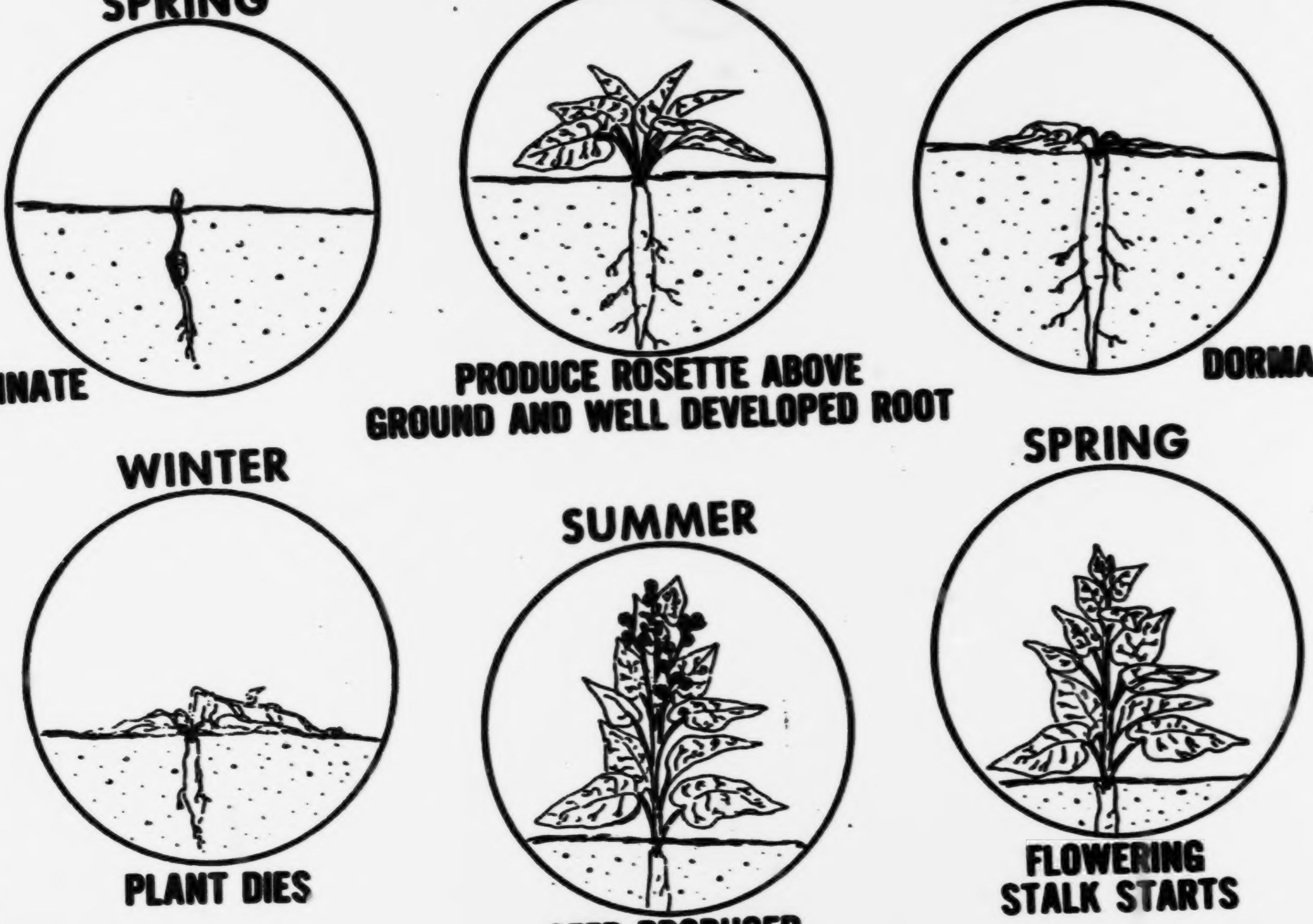
WINTER

DIE IN WINTER

TM #7

CSS 21 24

BIENNIALS



SPRING

GERMINATE

SUMMER FALL

PRODUCE ROSETTE ABOVE GROUND AND WELL DEVELOPED ROOT

WINTER

DORMANT

WINTER

PLANT DIES

SUMMER

SEED PRODUCED

SPRING

FLOWERING STALK STARTS

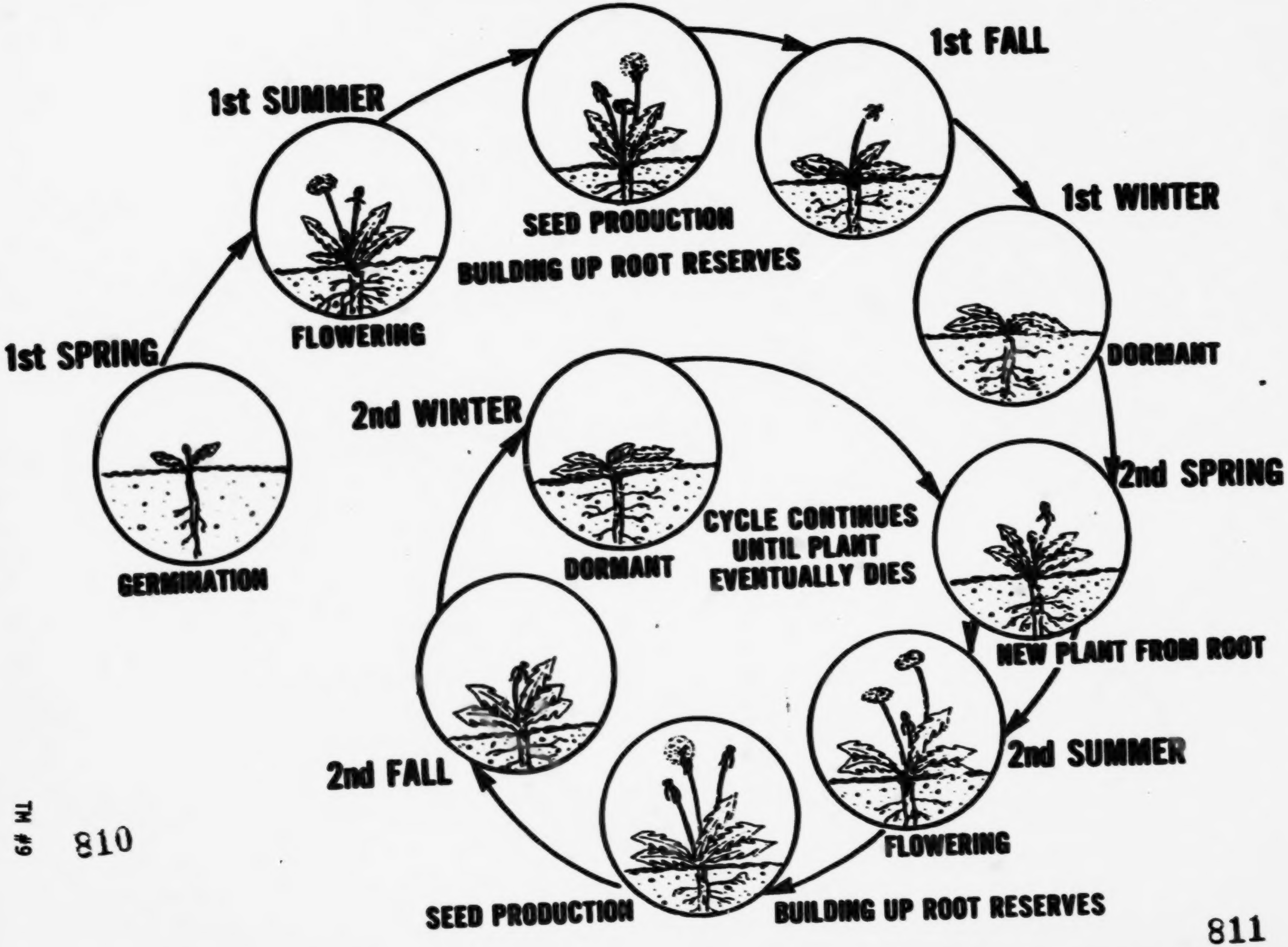
TM #8

CSS 21 25

808

809

PERENNIALS


1st SPRING
GERMINATION
1st SUMMER
FLOWERING
SEED PRODUCTION
BUILDING UP ROOT RESERVES
1st FALL
1st WINTER
DORMANT
2nd SPRING
NEW PLANT FROM ROOT
2nd SUMMER
FLOWERING
BUILDING UP ROOT RESERVES
SEED PRODUCTION
2nd FALL
2nd WINTER
DORMANT
CYCLE CONTINUES
UNTIL PLANT
EVENTUALLY DIES

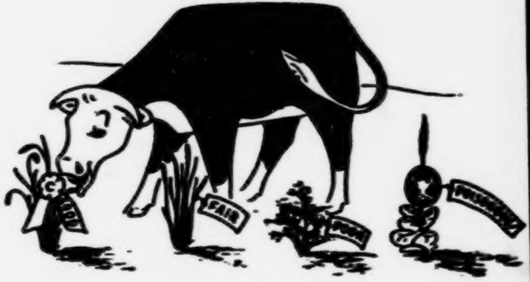
TM #9

CSS 21 26

Palatability of Grasses

Very palatable

- Bluebunch wheatgrass
- Idaho fescue
- Orchard grass



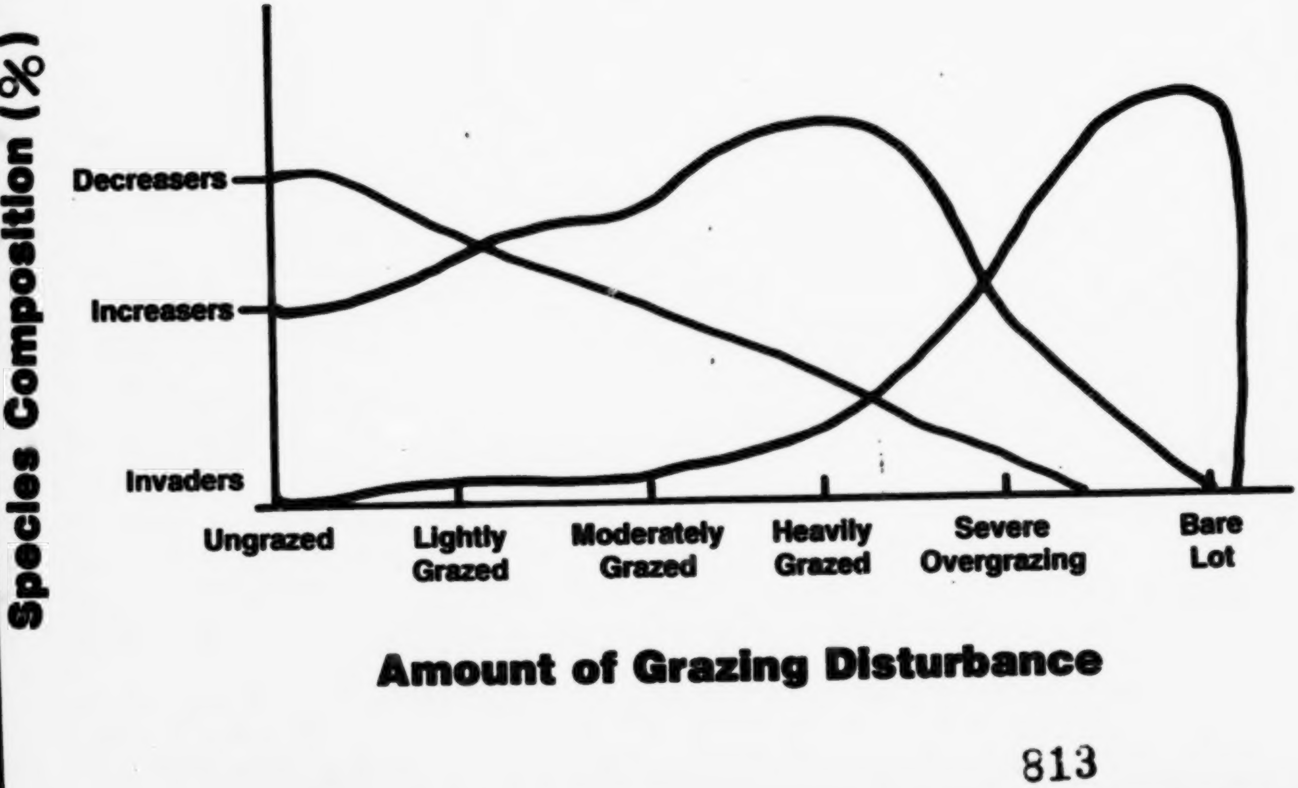
Palatable

- Crested wheatgrass
- Kentucky bluegrass
- Junegrass

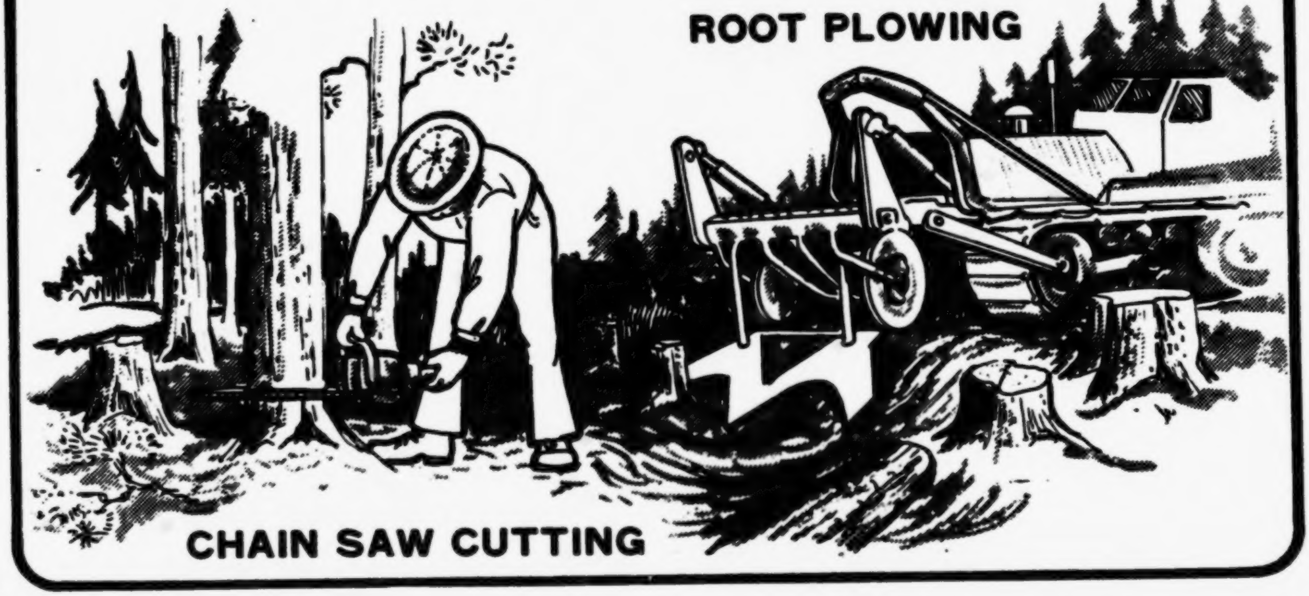
Less Palatable

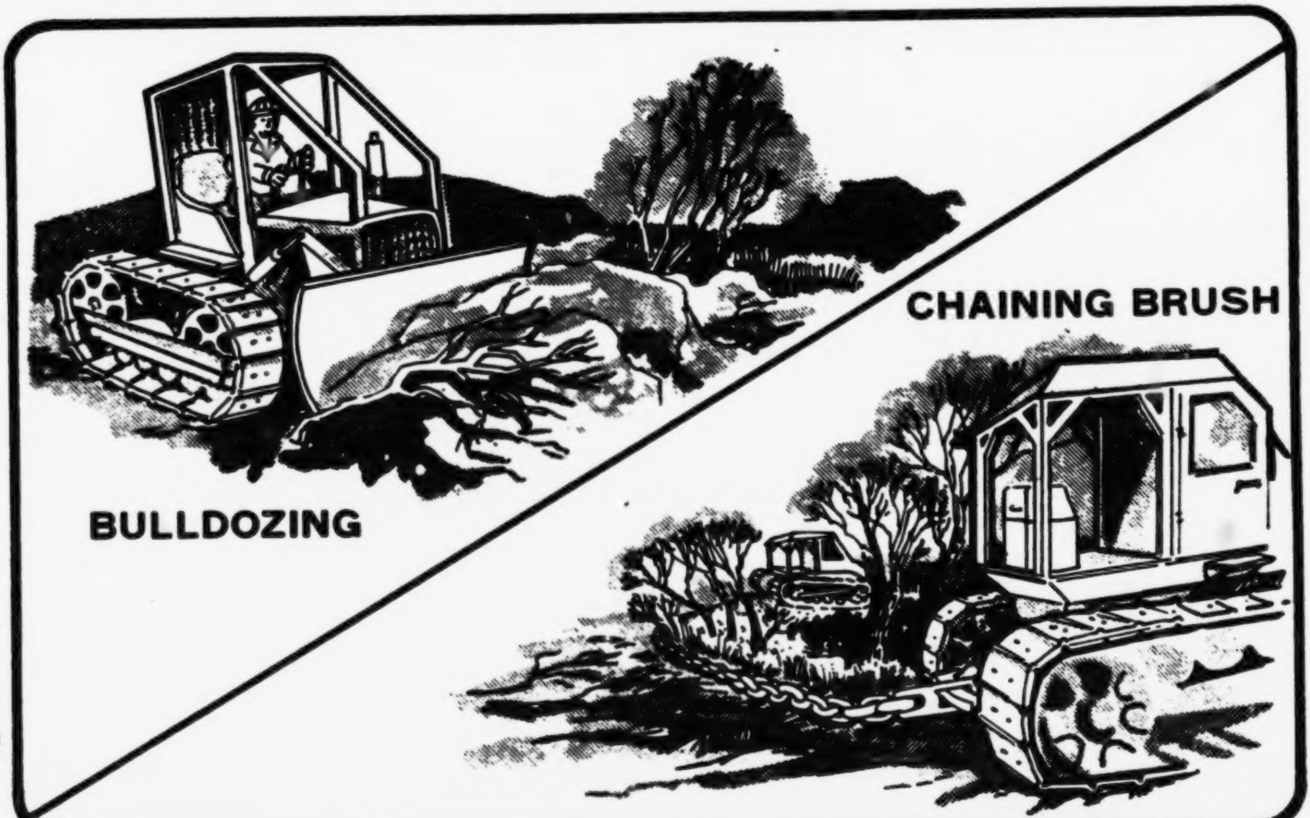
- Cheatgrass
- Medusahead
- Three awn

Vegetative Retrogression of Plants Species Based on Their Response to Disturbance Such as Overgrazing

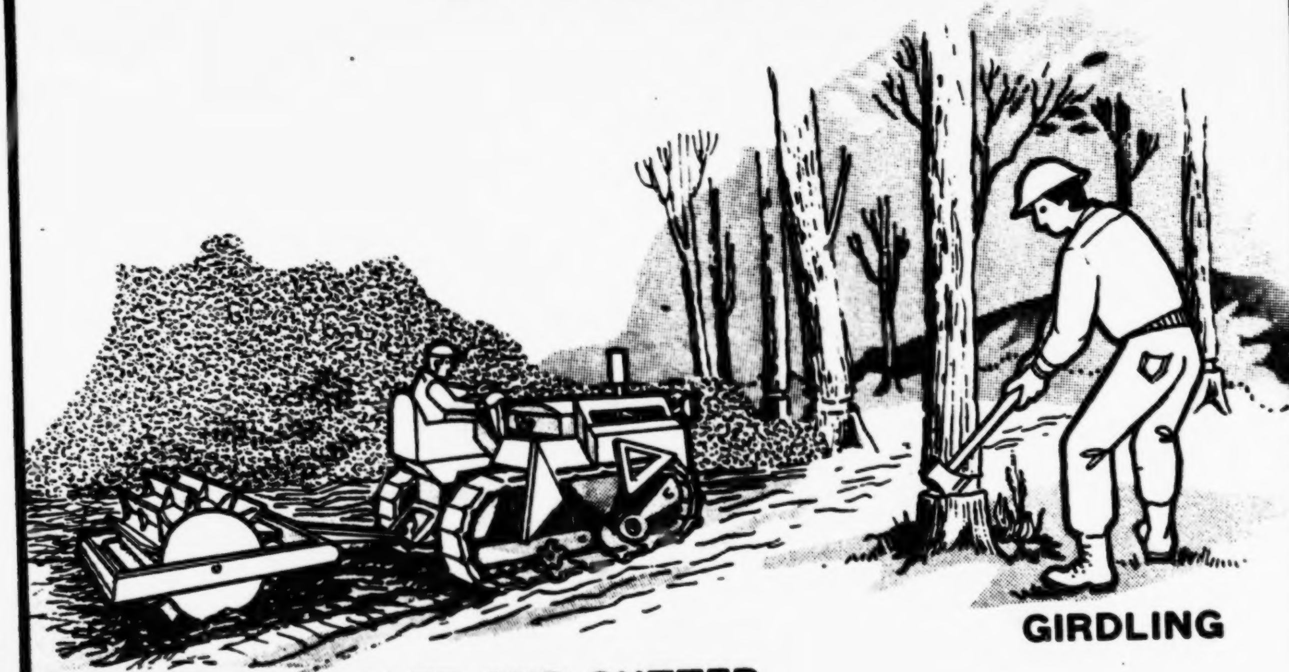


MECHANICAL METHODS OF CONTROL


ROOT PLOWING
CHAIN SAW CUTTING

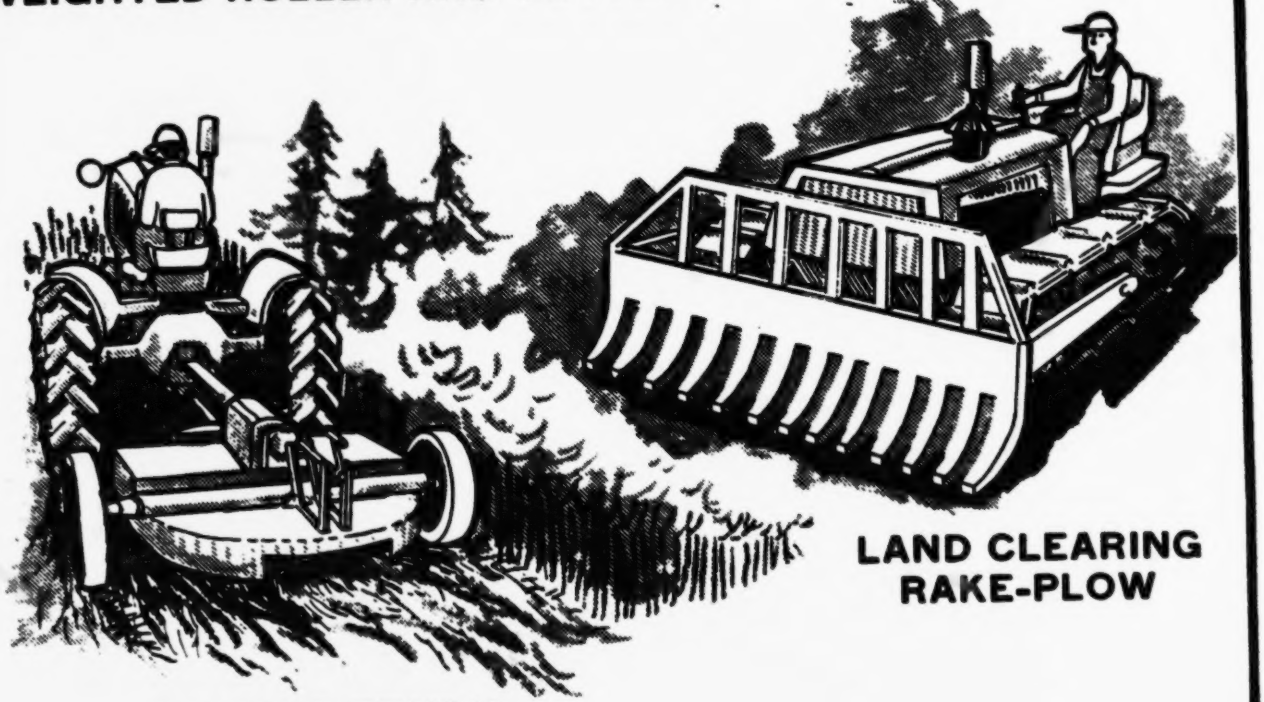

CHAINING BRUSH
BULLDOZING

MECHANICAL METHODS OF CONTROL



WEIGHTED ROLLER AND CUTTER

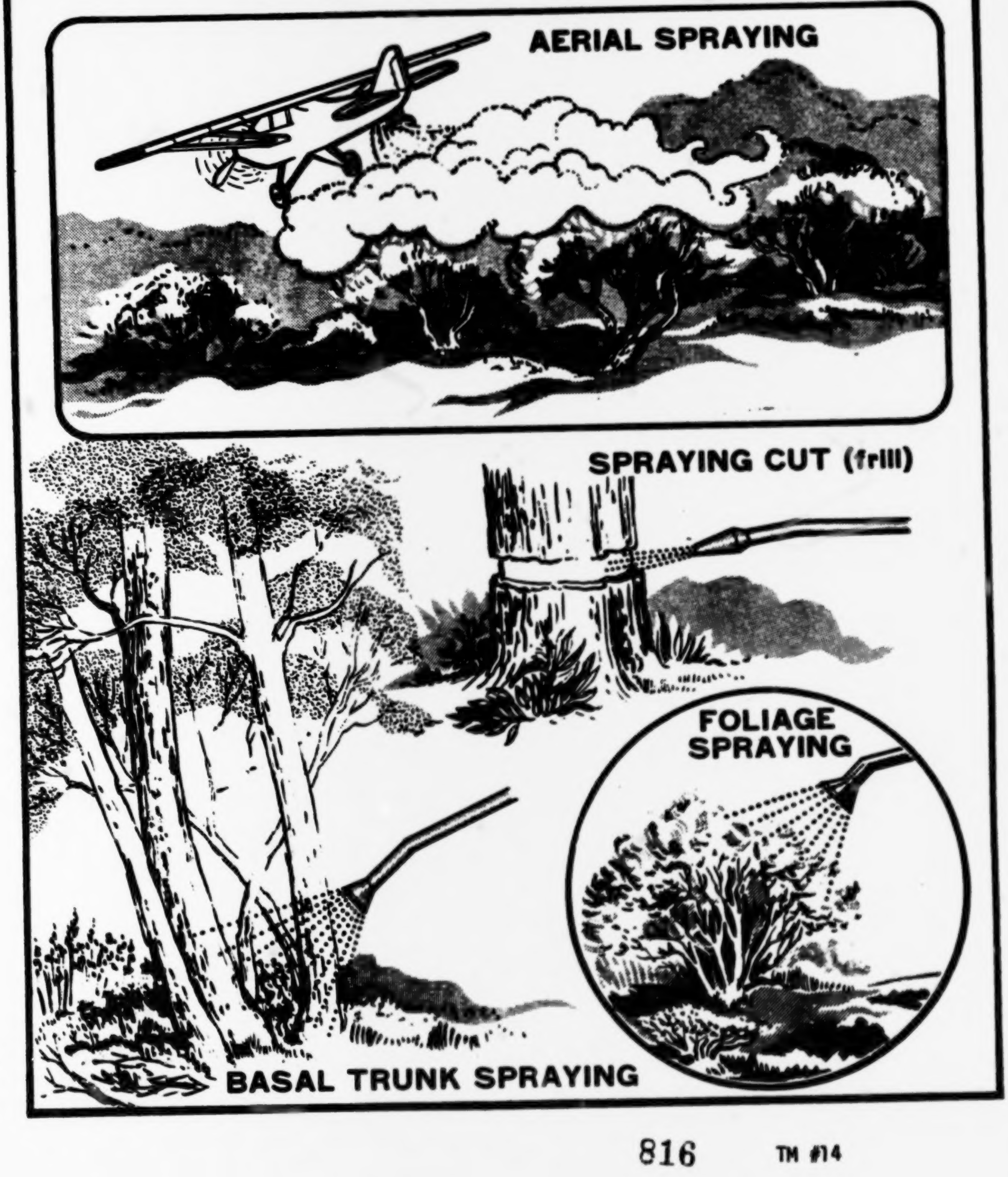
GIRDLING



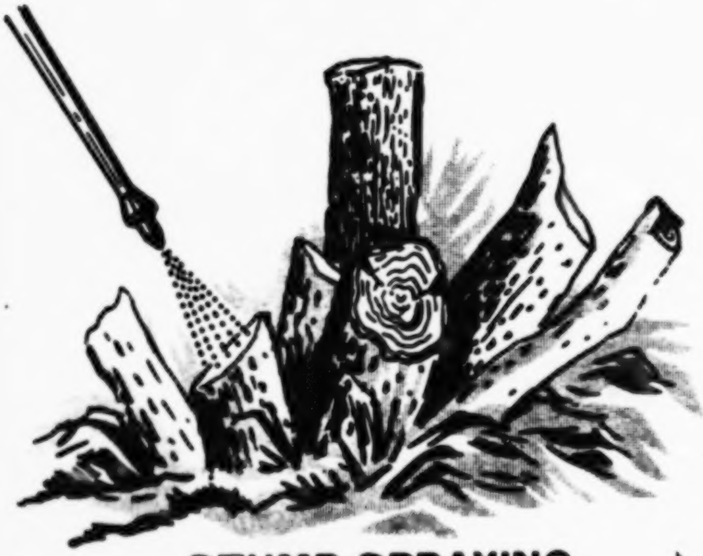
LAND CLEARING RAKE-PLOW

MOWING BRUSH

CHEMICAL CONTROL

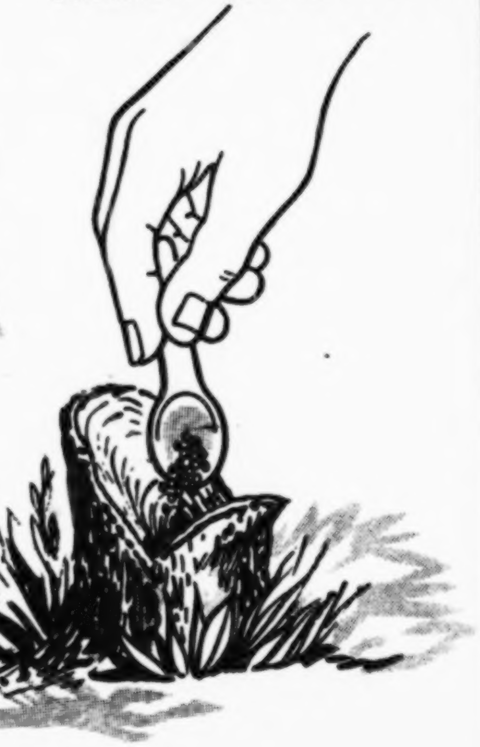

AERIAL SPRAYING
SPRAYING CUT (frill)
FOLIAGE SPRAYING
BASAL TRUNK SPRAYING

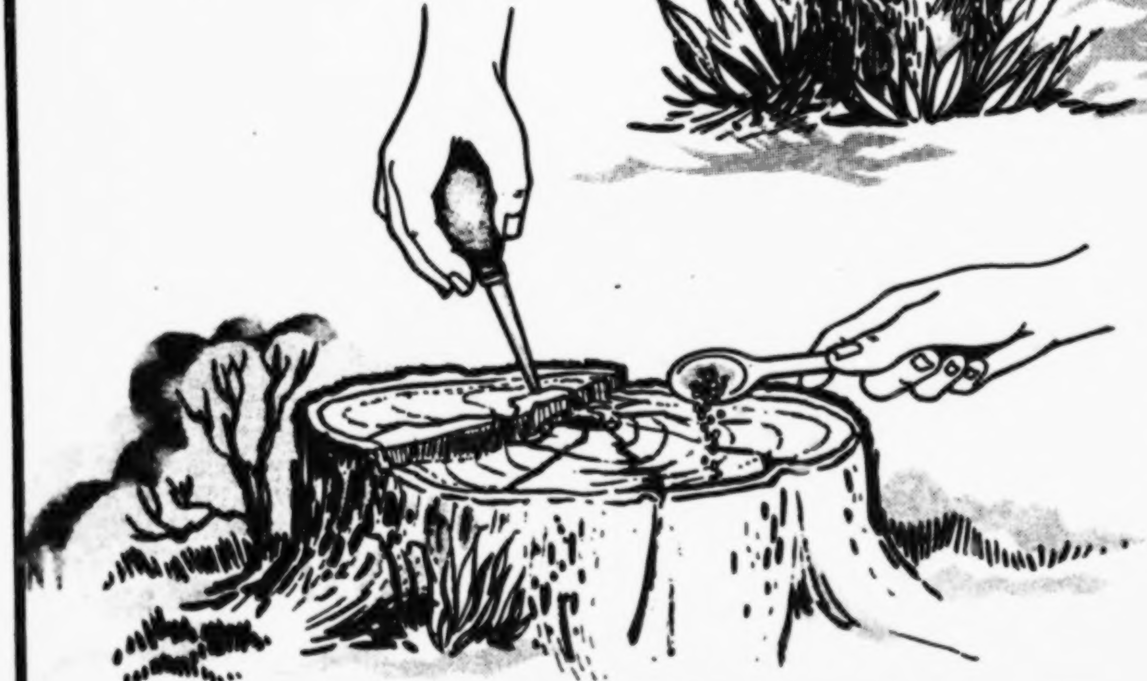
CHEMICAL CONTROL



STUMP SPRAYING

"V" NOTCH HOLDS CRYSTALS





APPLYING AMMATE CRYSTALS TO STUMP

Animal Unit Equivlent

1 cow	1.0 A.U.
1 yearling	0.6 A.U.
1 bull	1.3 A.U.
1 horse	1.5 A.U.
5 ewes	1.0 A.U.
5 deer	1.0 A.U.
10 antelope	1.0 A.U.
1 elk	0.8 A.U.
160 ground squirrels	1.0 A.U.

RANGELAND MANAGEMENT
UNIT 21

TEST

NAME ______________________________ SCORE ____________

1. Match terms associated with rangeland management to the correct definitions. Write the correct numbers in the blanks.

   1. Range
   2. Native plant
   3. Introduced plant
   4. Climax
   5. Grass
   6. Grass-like
   7. Forb
   8. Shrub
   9. Palatability
   10. Decreasers
   11. Increasers
   12. Invader
   13. Forage value
   14. Warm-season plant
   15. Cool-season plant
   16. Range condition
   17. Range trend
   18. Range utilization
   19. Animal unit
   20. Animal unit month
   21. Range management
   22. Range improvement
   23. Stocking rate
   24. Grazing plan

_____a. Amount of forage removed from a range area by grazing animals

_____b. Resembling grasses; usually used for sedges and rushes

_____c. Plant originating in North America

_____d. Plant which comes into a range after both increasers and decreasers have been reduced

_____e. Plant which grows during the fall, winter, or spring

_____f. The amount of feed or forage required by an animal unit for one month

_____g. A plan for grazing rangeland based upon the range condition and types of vegetation

_____h. Land not suited for cultivation, which supports a cover of vegetation suitable for grazing by animals

_____i. The degree of an animals desire to graze or not to graze a certain plant

_____j. Special treatments, developments, and structures used to improve range forage resources or to facilitate their use by grazing animals

_____k. The direction of change in range condition

_____l. The thrifty productive grasses that comprise a high percentage of the grass cover of a range in top condition

TEST

_____m. Plant that increases on a range when decreasers are reduced

_____n. A plant with a solid, non-woody stem, usually broadleaf with netted veination

_____o. The current productivity of a range relative to what that range is naturally capable of producing

_____p. The care and use of rangeland for multiple uses including the highest continuous yield of animal products without endangering soil and water resources

_____q. Number of animal units that are grazed in a certain area for a certain period of time

_____r. One mature cow or equivalent based upon average daily forage consumption of 12 kg. dry matter per day

_____s. Plant which grows during the summer and early fall

_____t. Any plant of the family Gramineae; characteristic of long narrow leaves with parallel veination

_____u. Rating of a plant as a feed for cattle or sheep

_____v. A woody perennial plant with a solid woody stem which is characteristic of growth rings

_____w. Plant brought from countries outside the United States

_____x. Plant that decreases on a range when exposed to heavy grazing pressures

2. List three uses of rangeland.

a. ____________________

b. ____________________

c. ____________________

3. Give the percentage of rangeland in the:

a. World

b. United States

c. Idaho

TEST

4. List four kinds of plants found on range sites.

a.______________________________________

b.______________________________________

c.______________________________________

d.______________________________________

5. List three classifications of range plants other than by structure.

a.______________________________________

b.______________________________________

c.______________________________________

6. Select from the following list characteristics of a good rangeland plant. Write an "X" in the blank before each correct answer.

_____a. Drought tolerant

_____b. Good palatability

_____c. Good nutritional qualities

_____d. Hardiness

_____e. Easy to establish

_____f. Soil building/holding

7. Classify the following grasses as very palatable (A), palatable (B), or less palatable (C). Write the correct letter in the blank before each statement.

_____a. Medusahead

_____b. Idaho fescue

_____c. Kentucky bluegrass

_____d. Cheatgrass

_____e. Crested wheatgrass

_____f. Bluebunch wheatgrass

TEST

8. Select from the following list factors affecting forage growth. Write an "X" in the blank before each correct answer.

_____a. Temperature

_____b. Texture of soil

_____c. Rainfall

_____d. Structure of soil

_____e. Minerals in the air

_____f. Sunlight

_____g. Oxygen content in soil

_____h. Nutrients in the soil

_____i. Topography

9. Match the periods of plant growth on western ranges to the correct definitions. Write the correct numbers in the blanks.

1. Period 1
2. Period 2
3. Period 3
4. Period 4

_____a. The flush period where animal demand is usually less than the forage supply; nutrition is high, and animals gain well during the entire period

_____b. Dormant period, the longest period of the year; during this period, nutritional values may limit animal performance

_____c. Initial growth, usually in spring; growth is slow; cattle cannot usually get enough new growth to satisfy their intake needs; plant growth is less than animal demand; this period is before traditional range readiness

_____d. Plant growth is just about even with animal demand; usually a short time; nutritional values are just about adequate to meet requirements

10. List four factors to consider in planning grazing.

a.____

b.____

c.____________________ ____________________

d.____

TEST

11. Discuss what a grazing plan should include.

12. List three general and two specific objectives of a grazing system.

A. General

1.

2.

3.

B. Specific

1.

2.

TEST

13. Match grazing systems to the correct descriptions. Write the correct numbers in the blanks.

1. Deferred	4. Continuous
2. Rested	5. Repeated seasonal
3. Ungrazed	6. Rotational

_____a. Range receiving a period of no grazing which is not rested or deferred

_____b. Moving livestock from one area of range to another on a scheduled basis

_____c. A range is not grazed for an entire year

_____d. A range is not grazed until seed maturity is assured, or a comparable growth stage

_____e. Grazing the range the same time each year

_____f. The grazing of a range continuously throughout the year

14. List three classes of plant response to range disturbance.

a.______________________________

b.______________________________

c.______________________________

15. Match range conditions to the correct descriptions. Write the correct numbers in the blanks.

1. Excellent	3. Fair
2. Good	4. Poor

_____a. 76 to 100 percent of the vegetation is a mixture of highly palatable and desirable plants

_____b. 51 to 75 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants

_____c. 26 to 50 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants

_____D. Less than 25 percent of all vegetation consists of highly palatable and desirable plants

TEST

16. Select from the following list benefits received from range improvement practices. Write an "X" in the blank before each correct answer.

_____a. Erosion control

_____b. Increased fire hazard

_____c. Increased quantity of forage

_____d. Decreased quantity of forage

_____e. Increased quality of forage

_____f. Decreased wildlife production

17. List five range improvement practices.

a.____

b.____

c.____

d.____

18. Arrange in order the steps in the range improvement process. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Maintain proper range management practices and evaluate effect of improvement practices

_____b. Implement selected range improvement practices

_____c. Select range improvement practices best suited for the situation

_____d. Identify cause of poor performance by range.

19. List two methods to prevent overgrazing.

a.____

b.____

20. List three methods of weed and brush control.

a.____

b.____

c.____

TEST

21. Discuss the control of undesirable animals.

22. Calculate the animal unit equivalent, and the amount of forage consumed per month for the following examples.

(Note: One animal unit will consume 26 pounds of dry forage per day.)

a. 45 beef cows

b. 1000 ewes

c. 25 deer

d. 15 elk

e. 10 horses

23. Discuss the determination of stocking rate.

TEST

24. List three classes of range utilization.

a.______________________________________

b.______________________________________

c.______________________________________

25. List three agencies involved in rangeland management.

a.______________________________________

b.______________________________________

c.______________________________________

26. List two significant legislative acts to rangeland management.

a.______________________________________

b.______________________________________

RANGELAND MANAGEMENT
UNIT 21

ANSWERS TO TEST

1. a. 18
   b. 6
   c. 2
   d. 12
   e. 15
   f. 20
   g. 24
   h. 1
   i. 9
   j. 22
   k. 17
   l. 4
   m. 11
   n. 7
   o. 16
   p. 21
   q. 23
   r. 19
   s. 14
   t. 5
   u. 13
   v. 8
   w. 3
   x. 10

2. Answer should include any three of the following.

   a. Livestock production
   b. Watershed
   c. Wildlife
   d. Recreation
   e. Energy reserves

3. a. 47% b. 47% c. 85%

4. a. Grasses
   b. Grass-like
   c. Forbs
   d. Shrubs

5. a. Life span b. Origin c. Growth season

6. a, b, c, d, e, f

7. a. C
   b. A
   c. B
   d. C
   e. B
   f. A

8. a, b, c, d, f, h, i

9. a. 3 b. 4 c. 1 d. 2

10. a. Intensity of use
    b. Frequency of use
    c. Season of use
    d. Selectivity of use

11. Evaluated to satisfaction of instructor

12. Evaluated to satisfaction of instructor

13. a. 3
    b. 6
    c. 2
    d. 1
    e. 5
    f. 4

ANSWERS TO TEST

14. a. Decreaser
    b. Increaser
    c. Invader

15. a. 1
    b. 2
    c. 3
    d. 4

16. a, c, e

17. Evaluated to satisfaction of instructor

18. a. 4
    b. 3
    c. 2
    d. 1

19. Answer should include any two of the following.

    a. Rotate pastures
    b. Graze lightly during seed production seasons
    c. Regulate animal units

20. a. Mechanical
    b. Burning
    c. Chemical

21. Evaluated to satisfaction of instructor

22. a. 45.0 animal units; 35,100 lbs. or 17.55 tons
    b. 200 animal units; 156,000 lbs. or 78 tons
    c. 5 animal units; 3900 lbs. or 1.95 tons
    d. 12 animal units; 9360 lbs. or 4.68 tons
    e. 15 animal units; 11,700 lbs. or 5.85 tons

23. Evaluated to satisfaction of instructor

24. a. Heavy use
    b. Moderate use
    c. Light use

25. Evaluated to satisfaction of instructor

26. Evaluated to satisfaction of instructor

SPECIALTY CROPS
UNIT 22

UNIT OBJECTIVE

After completing this unit, the student should be able to match terms associated with specialty crops to the correct definition. The student should also be able to list poor, average, and excellent yields for specialty crops. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with specialty crops to the correct definitions.
2. Select from a list specialty crops produced in Idaho.
3. Summarize the production of one specialty crop produced in Washington
4. Give Washington's rank in the nation in the production of specialty crops.
5. Classify specialty crops by the percentage change in economic value.

SPECIALTY CROPS
UNIT 22

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

      a. Publications available from University of Idaho. For a catalog of publications write to: Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, ID 83843

      b. Publications available from Washington State University. For a catalog of publications write to: Bulletin Department, Cooperative Extension, Cooper Publications Building, Washington State University, Pullman, WA 99164

      c. Publications available from Oregon State University. For a catalog of publications write to: Bulletin Mailing Office, Industrial Building, Oregon State University, Corvallis, OR 97331

      d. Publications available from Department of Agriculture. For a catalog of publications write to: Washington Crop and Livestock Reporting Service, 417 West 4th Ave., Olympia, WA 98501

    2. Filmstrips, slideshows, etc.

    3. Films

  B. Make transparencies

  C. Provide students with objective sheet

  D. Provide students with information sheet

  E. Discuss unit and specific objectives

  F. Discuss information sheet

  G. Give test

  H. Reteach if necessary

  I. Retest

SUGGESTED ACTIVITIES

II. Instructional materials
  A. Objective sheet
  B. Suggested activities
  C. Information sheet
  D. Test
  E. Answers to test

III. Unit references
  A. Washington Agricultural Statistics; 1983-84

SPECIALTY CROPS
UNIT 22

INFORMATION SHEET

I. Terms and definitions

   A. Grain--The seed of any cereal plant, such as wheat, barley, and oats

   B. Forage--Vegetative material in a fresh, dried, or ensiled state which is fed to livestock

   C. Pulses--Leguminous plants or their seeds; this includes chiefly those plants with large seed used for food

   D. Legume--Soil improving plant which manufactures nitrogen

   E. Root crop--Plant that stores food and is harvested primarily for its root

   F. Tree crop--Tree that is raised for the harvest of its fruit

   G. Oil seed crop--Plants harvested primarily for the oil in their seeds or leaves

   H. Warm-season crop--Makes best growth under relatively warm conditions; are generally damaged by cold weather; includes beans, corn, and sugarbeets

   I. Cool-season crop--Makes best growth under relatively cool conditions; are generally damaged by warm weather; includes wheat, barley, and oats

   J. Grass--Plant with longer, narrower leaves with parallel veination; monocots

   K. Broadleaf--Plant with shorter, wider leaves that usually have pinnate or netted veination; dicots

   L. Annual--Completes life cycle within a period of one year

   M. Perennial--Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

   N. Cwt--Hundred weight; 100 pounds

   O. Bushel--Thirty-two dry quarts

   P. Ton--Two-thousand pounds

INFORMATION SHEET

II. Specialty crops produced in Washington

   A. Field crops

      1. Winter wheat
      2. Spring Wheat
      3. Barley
      4. Corn
      5. Dry Beans
      6. Mint
      7. Potatoes

   B. Fruit Crops

      1. Apples
      2. Grapes
      3. Apricots
      4. Pears
      5. Peaches
      6. Prunes

   C. Vegetable crops

      1. Carrots
      2. Sweet corn
      3. Lettuce
      4. Onions
      5. Asparagus
      6. Green peas

   D. Berry crops

      1. Blackberries
      2. Blueberries
      3. Cranberries
      4. Raspberries
      5. Strawberries

INFORMATION SHEET

III. Cash receipts from marketing crops produced in Washington

COMMODITY	1981	1982	1983	1982 as % of all commodities
			1,000 Dollars	
Wheat	629,292	606,979	642,238	20.9
Potatoes	183,338	158,880	208,705	6.8
Barley	88,972	96,728	136,746	4.5
Hops	89,205	93,067	92,060	3.0
Hay	78,549	96,698	102,966	3.4
Corn, Grain	31,057	36,930	47,454	1.5
Mint	16,365	13,503	15,672	.5
Dry beans	28,814	12,360	8,360	.3
Apples	227,785	294,238	257,253	8.4
Pears	51,035	53,992	58,980	1.9
Sweet cherries	41,208	37,688	55,547	1.8
Grapes	29,970	31,167	41,492	1.4
Carrots	22,392	25,407	26,377	.9
Sweet corn	19,909	36,359	23,054	.7
Green peas	25,534	31,321	18,103	.6
Onions	21,966	12,718	14,466	.5
Beans, snap	829	1,351	815	.0
Strawberries	6,440	8,072	7,777	.3
Cranberries	5,379	4,192	5,934	.2
Mushrooms	4,723	6,069	5,473	.2
Forest Products	70,113	68,401	66,720	2.2
Greenhouse	97,000	96,000	100,000	3.2

IV. Did you know?

A. Agriculture is a $3 billion industry in Washington State, processed food products $5 billion, and forest products $6 billion

B. 350,000 people are employed in jobs created and induced by agriculture

C. Agriculture contributed $1.2 billion to Washington State exports

D. An average Washington State farm has 450 acres

E. Washington State has 37,730 farms

F. 25,000 of those 37,730 farms have sales of less than $20,000 per year

G. Production expenses for farmers in Washington equal $2.7 billion

H. Agriculture holds 17 million acres in production in Washington State

I. Nationally, Washington State holds a top-ten ranking in 24 separate commodities

INFORMATION SHEET

V. Nationally, Washington ranks

- A. 1st in:
  1. Apples
  2. Sweet cherries
  3. Hops
  4. Spearmint oil
  5. Lentils
  6. Red raspberries
  7. Dry edible peas
- B. 2nd in:
  1. Fall potatoes
  2. Pears
  3. Grapes
  4. Asparagus
  5. Blackberries

VI. Nationally, Washington produces

- A. 79% of all lentils
- B. 33% of all kentucky bluegrass
- C. 35% of all asparagus
- D. 53% of all red raspberries
- E. 21% of all processed green peas
- F. 21% of all prunes and plums
- G. 30% of all pears
- H. 35% of all apples
- I. 30% of all sweet cherries
- J. 75% of all hops
- K. 18% of all fall potatoes
- L. 62% of all dry edible peas
- M. 66% of all spearmint oil

SPECIALTY CROPS
UNIT 22

TEST

NAME_______________________________________ SCORE_______________

1. Match terms associated with specialty crops to the correct definitions. Write the correct numbers in the blanks.

1. Grain
2. Forage
3. Pulses
4. Legume
5. Root crop
6. Tree crop
7. Oil seed crop
8. Warm-season crop
9. Cool-season crop
10. Grass
11. Broadleaf
12. Annual
13. Perennial
14. Cwt.
15. Bushel
16. Ton

_____a. Makes best growth under relatively warm conditions; are generally damaged by cool weather; includes beans, corn, and sugar beets

_____b. Completes life cycle within a period of one year

_____c. Plant with longer, narrower leaves with parallel veination; monocots

_____d. Leguminous plants or their seeds; this includes chiefly those plants with large seed used for food

_____e. Tree that is raised for the harvest of its fruit

_____f. Two-thousand pounds

_____g. The seed of any cereal plant, such as wheat, barley, and oats

_____h. Soil improving plant which manufactures nitrogen

_____i. Thirty-two dry quarts

_____j. Makes best growth under relatively cool conditions; are generally damaged by warm weather; includes wheat, barley, and oats

_____k. 100 pounds

_____l. Plants harvested primarily for the oil in their seeds or leaves

_____m. Vegetative material in a fresh, dried, or ensiled state which is fed to livestock

TEST

_____n. Plant that stores food and is harvested primarily for its root

_____o. Lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

_____p. Plant with shorter, wider leaves that usually have pinnate or netted veination; dicots

2. Select from the following list specialty crops produced in Washington. Write an "X" in the blank before each correct answer.

_____a. Carrots

_____b. Sweet corn

_____c. Wheat

_____d. Grapes

_____e. Hops

_____f. Corn, grain

_____g. Onions

_____h. Mint oil

_____i. Soybeans

_____j. Dry beans

_____k. Sunflower

_____l. Sweet cherries

_____m. Lettuce

_____n. Cotton

_____o. Blueberries

_____p. Bluegrass seed

_____q. Prunes

_____r. Lentils

_____s. Apricots

_____t. Tobacco

TEST

3. Summarize the production of one specialty crop produced in Washington

TEST

4. Give Washington's rank in the nation in the production of the following specialty crops. Write the correct numbers in the blanks.

   _____a. Apples

   _____b. Sweet cherries

   _____c. Hops

   _____d. Fall potatoes

   _____e. Pears

   _____f. Spearmint oil

   _____g. Lentils

   _____h. Red raspberries

   _____i. Dry edible peas

   _____j. Asparagus

5. Classify the following specialty crops by the percentage change in economic value. Write an "+" in the blank if it is a positve change, and a "-" if it is a negative change.

   _____a. Lentils

   _____b. Hops

   _____c. Fall potatoes

   _____d. Spearmint oil

   _____e. Processed green peas

   _____f. Kentucky bluegrass

   _____g. Asparagus

   _____h. Pears

   _____i. Dry edible peas

   _____j. Red raspberries

SPECIALTY CROPS
UNIT 22

ANSWERS TO TEST

1. a. 8
   b. 12
   c. 10
   d. 3
   e. 6
   f. 16
   g. 1
   h. 4
   i. 15
   j. 9
   k. 14
   l. 7
   m. 2
   n. 5
   o. 13
   p. 11

2. a, b, c, d, e, f, g, j, l, m, o, q, r, s

3. Evaluated to satisfaction of instructor

4. a. 1
   b. 1
   c. 1
   d. 2
   e. 2
   f. 1
   g. 1
   h. 1
   i. 1
   j. 2

5. a. +
   b. +
   c. +
   d. +
   e. +
   f. +
   g. +
   h. +
   i. +
   j. +

CROP STORAGE
UNIT 23

UNIT OBJECTIVE

After completing this unit, the student should be able to match terms and definitions, list kinds of storage facilities, and discuss factors affecting crop storability. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with crop storage to the correct definitions.
2. List three causes of deterioration in storage.
3. Select from a list methods of postharvest preservation of crops.
4. Select from a list advantages of proper crop storage.
5. Name three types of crop storage.
6. List two reasons farm storage is needed.
7. Name five kinds of grain storage facilities.
8. Discuss the functions of harvesting machines.
9. Select from a list factors affecting crop storability.
10. Select from a list conditions of a safe storage facility.
11. Select from a list factors which affect length of storage time.
12. List two basic rules for storing seed.
13. List three ways of packaging seed for storage.
14. Discuss the control of insects in storage.
15. List three seed treatments used in disease control.
16. Discuss the control of rodents and birds in storage.

OBJECTIVE SHEET

17. List two crops stored for relatively short periods.
18. List two crops stored for relatively long periods.
19. Select from a list factors to consider in planning storage facilities.
20. Discuss measures to prevent suffocation in grain.

CROP STORAGE
UNIT 23

SUGGESTED ACTIVITIES

I. Suggested activities

   A. Order materials to supplement unit

      1. Literature

         a. Several publications available from the University of Idaho. Order list of available publications from: Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, ID 83843

         b. Several publications available from Washington State University. Order publications catalog from: Bulletin Department, Cooperative Extension, Cooper Publications Building, Washington State University, Pullman, WA 99164-5912

         c. Several publications available from Oregon State University. Order publications catalog from: Bulletin Mailing Office, Oregon State University, Corvallis, OR 97331

      2. Filmstrips, slideshows, etc.

      3. Films

   B. Make transparencies

   C. Provide students with objective sheet

   D. Provide students with information sheet

   E. Discuss unit and specific objectives

   F. Discuss information sheet

SUGGESTED ACTIVITIES

- G. Develop appropriate learning activities
- H. Give test
- I. Reteach if necessary
- J. Retest

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Test
- E. Answers to test

III. Unit references

- A. Will There Be Enough Food? USDA Yearbook of Agriculture, 1981
- B. Protecting Our Food. USDA Yearbook of Agriculture, 1966
- C. Christensen, C.M. Storage of Cereal Grains and Their Products. St. Paul, MN. American Association of Cereal Chemists, Inc. 1982
- D. Thomson, J.R. An Introduction to Seed Technology. New York, N.Y. John Wiley and Sons. 1979
- E. Christensen, C.M. and Kaufmann, H. Grain Storage, The Role of Fungi in Quality Loss. Minneapolis, MN. University of Minnesota Press. 1969
- F. Copeland, L.O. and McDonald, M.B. Principles of Seed Science and Technology, 2nd edition, Minneapolis, MN. Burgess Publishing Company. 1985
- G. Agricultural Machinery Safety. Fundamentals of Machine Operation. Moline, IL. John Deere Service Publications. 1974
- H. Safety Handbook, College of Agriculture, Cooperative Extension Service, University of Idaho, Moscow, ID 1980

SUGGESTED ACTIVITIES

I. Farrington, W.E., et al. Fertilizers, Chemicals and Seed. New York, N.Y. McGraw-Hill Book Company. 1980

J. Hartmann, H.T., et al. Plant Science; Growth, Development, and Utilization of Cultivated Plants. Englewood Cliffs, New Jersey. Prentice-Hall, Inc. 1981

CROP STORAGE
UNIT 23

INFORMATION SHEET

I. Terms and definitions

A. Pest--Any living organism that damages crops or is annoying or destructive to humans in some way

B. Pesticide--Any substance used to kill insects, rodents, weeds, or other pests

C. Fungicide--A pesticide used to kill fungi

D. Insecticide--A chemical or other substance used to kill or control populations of insects and related animals

E. Fumigation--The process of using chemicals in a gaseous form in order to kill pathogens or insect pests

F. Pathogen--Disease-causing microscopic organisms

G. Relative humidity--The ratio, expressed as a percentage, of the quantity of water vapor actually present in the air to the greatest amount it could contain at that temperature

H. Moisture content--The weight of water in a crop sample expressed as a percentage of the total weight of the sample

I. Perishable--Something liable to spoil or deteriorate quickly, such as food with high moisture content

J. Aeration--Process of moving small amounts of air through the stored crop at low flow rates to remove moisture and/or to cool the crop, and thus prevent deterioration of crop quality

K. Spontaneous combustion--The process of ignition and burning as a result of heat generated by internal chemical action

L. Crop preservation--Retardation of physiological processes in plant tissues to present a finished product in an attractive or usable form

M. Germination--The point at which a seed or plant vegetative reproductive organ having adequate moisture, temperature, and oxygen begins to grow

N. Germination capacity--The percentage of seeds or plant vegetative reproductive organs capable of germinating to produce seedlings robust enough to establish in good field conditions

O. Crib--A structure with a roof and open sides for drying corn ears

INFORMATION SHEET

II. Causes of deterioration in storage

(Note: What does it take to protect stored commodities against quality loss and damage from pests? It takes facilities that are built right, practices that deter spoilage and pest attacks, and exactly controlled use of chemicals to create surroundings hostile to molds, insects, and other hazards.)

A. Physical

1. High temperature

2. Moisture

B. Chemical

1. Physiological degradation from aging

2. Improper use of storage pesticides

C. Biological

1. Rodents

2. Insects, fungi and bacteria

III. Methods of postharvest preservation of crops

A. Preservation by cooling

1. Refrigeration

2. Hydrocooling

3. Forced air cooling

4. Vacuum cooling

B. Preservation by drying

1. Dehydration by hot forced air

2. Dehydration by freezing

C. Preservation by modified atmospheres

1. Vacuum storage

2. Control of relative humidity

3. Control of temperature

4. Control of oxygen and carbon dioxide levels

INFORMATION SHEET

D. Preservation by processing

1. Canning (heat)

2. Quick freezing

3. Processing with sugar

4. Processing with salt

5. Processing by milling

IV. Advantages of proper crop storage

A. Maintenance of crop quality

B. Decreased crop loss

C. Increased longevity of crop

D. Potential marketing advantage

(Note: Crop prices may increase if they are held in storage.)

E. Holding of crop until ready for use

(Note: Increased food production alone does not solve the world food problem. Food must be stored or preserved in an edible, nutritionally adequate condition until it can be distributed and consumed in and out of season. Proper storage prolongs the life of unprocessed plant products. Storage also moderates price by regulating the supply available to the market.)

V. Types of crop storage

A. On-farm storage

B. Cooperative storage

C. Custom storage

VI. Reasons on-farm storage space is needed

A. To hold crop immediately after harvest, until it can be moved to better storage space or to market

B. The producer can decide to delay marketing

C. The producer can hold for later consumption on his own farm

INFORMATION SHEET

VII. Kinds of grain storage facilities

A. On the ground

(Note: Grain should be piled on the ground only after harvest and in the absense of available storage space or available transport equipment to move it to a safer place.)

B. Underground

(Note: Its principle drawback is the high cost of grain handling.)

C. Bagged and stored in buildings

(Note: Bags can be transported and handled without special equipment. But both bags and bag storage space become expensive where manpower costs are high.)

D. Farm bins

(Note: Farm storage may consist of any available space that will hold grain and keep out moisture, ranging from wooden enclosures, round steel bins, to silo-type or quonset hut bins.)

E. Bin sites

(Note: In recent years, much of the surplus grain owned by the U.S. government has been stored in farm-type bins in large numbers, called bin sites.)

F. Country elevators

(Note: Country elevators receive grain directly from producers. Their principle function is to accumulate grain from nearby farms, to reload it into trucks, railroad cars, or barges, and to send it to market. In addition, they offer storage space and other services.)

G. Terminal elevators

(Note: Terminal elevators are usually located in transportation terminals and larger markets. They receive grain form country elevators and transfer it to storage or into other transportation equipment such as barges or other vessels.)

INFORMATION SHEET

VIII. Function of harvesting machines

A. Remove edible plant parts by cutting, digging, shaking or stripping

B. Gather plant parts

C. Separate desired from undesired parts

D. Cleaning

E. Loading crop for transport

(Note: A seed lot which has ripened under good conditions, has been well harvested, and has been properly dried, posesses, when it goes into storage, a high field planting value, i.e. the seeds are capable of producing strong seedlings able to establish themselves in adverse field conditions. During storage some of this value is lost, slowly or rapidly, depending on storage conditions.)

IX. Factors affecting crop storability

A. Length of storage

B. Moisture level

C. Temperature

(Note: The effect of low temperature is to slow down or stop processes contributing to deterioration.)

D. Maturity of crop at harvest

E. Crop variety

F. Aeration

G. Handling of crop

X. Conditions of a safe storage facility

A. Maintain quality and quantity

B. Protect from pests

C. Protect from moisture

INFORMATION SHEET

D. Protect from destructively high or low temperatures

E. Protect from objectionable odors and contamination

F. Protect against unauthorized distribution

(Note: A safe storage place must be provided for the greater part of the grain and other crops produced until they are needed for consumption, since crop production is seasonal, and consumption is continuous.)

XI. Factors which affect length of storage time

A. Current price and demand for crop

B. Availability of storage facilities

C. Kind of crop being stored

D. Condition and quality of the crop

E. Conditions of storage

F. Cash needs of the farmer

XII. Basic rules for storing seed

A. Store seed dry

B. Keep seed dry

(Note: Most problems that arise during seed storage can be traced to the neglect of one or both of these rules. Losses usually occur when seed is either stored with a high moisture content or it is allowed to accumulate moisture while it is in storage. The aim in storage is to maintain the germination capacity of the seed, and generally this requires more stringent conditions than the conservation of nutritional or industrial qualities. For practical purposes, storage life comes to an end when the germination capacity begins to fall.)

XIII. Ways of packaging seed for storage

A. Bulk

B. Burlap bags

C. Cotton bags

D. Paper bags and packets

E. Cardboard boxes

F. Cardboard drums

INFORMATION SHEET

XIV. Control of insects in storage

A. Storage bins should be cleaned prior to seed storage

B. Storage bins should be made as air-tight as possible

C. Do not store fresh seed on top of old seed

D. Treat inside of storage bins with approved insecticide

XV. Seed treatments used in disease control

A. Mechanical treatment

(Note: Mechanical treatment of seed removes any materials, such as soil or extraneous plant parts, that are mixed in with the seed and that may cause disease. This is one of the first steps in seed processing, and is actually a cleaning operation.)

B. Physical treatment

(Note: Physical treatment includes washing the seed with hot water; bombarding it with x-rays, ultraviolet rays, or gamma rays; and soaking it in water. These treatments are used to kill diseases on the surface of or within the seed.)

C. Chemical treatment

(Note: Chemical treatment is the most common method of treating seed. Chemical methods do the least amount of damage to the seed and appear to be the most effective in reducing losses from disease.)

XVI. Control of rodents and birds in storage

(Note: Rodents and birds are of concern not only because they eat seed, but also because they contaminate it and spread disease.)

A. Area around storage bins should be kept clean

(Note: Rubbish should be removed immediately, stacks of lumber and other materials in which birds and rodents might hide should be removed and storage bins should be made as air-tight as possible to prevent rodents and birds from reaching the seed.)

B. Use of poisons

(Note: Great care must be taken when using all poisons since they may be harmful to humans and to other animals.)

INFORMATION SHEET

XVII. Crops stored for relatively short periods

- A. Fresh fruits
- B. Vegetables

XVIII. Crops stored for relatively long periods

- A. Cereal grains
- B. Dried forage crops

XIX. Factors to consider in planning storage facilities

- A. Proper size for current and future needs
- B. Should preserve proper quality
- C. Should provide for control of:
  - 1. Light
  - 2. Temperature
  - 3. Moisture
  - 4. Pests
    - a. Insects
    - b. Rodents
    - c. Diseases
- D. Should be convenient for storing and removal of crops

XX. Measures to prevent suffocation in grain

(Note: You sink in about a foot when walking on dry grain in a grain bin. Grain removal will almost instantly submerge you over the knees. It takes less than 5 seconds to render you completely helpless. The average man occupies about 7 cubic feet of space. It takes about 20 seconds with a typical 6-inch auger to fill this space. That's how long it takes to completely sink and be covered by flowing grain.)

- A. NEVER enter a grain bin when unloading equipment is running, whether or not grain is flowing

  (Note: If grain bridges, shut off the unloader and use a pipe or some other long object to break the bridge and get the grain flowing again.)

INFORMATION SHEET

B. If you must enter a bin, disconnect the power source and make sure no one can turn it on while you're inside

(Note: If the grain should start flowing for some reason, stay near the outer wall and keep walking until the grain flow stops or the bin is empty.)

C. Install ladders in all bins

(Note: This will provide an exit if you need to get out, as well as a safe way of getting in. But remember that even if there is a ladder in the bin, you must be able to get to it. If you walk out to the center of the bin and get caught in the flowing grain, you may not be able to reach the ladder.)

D. If you must enter a bin, tie yourself with a rope and harness so you have a way of getting out

CROP STORAGE
UNIT 23

TEST

NAME____ SCORE_______________

1. Match terms associated with crop storage to the correct definitions. Write the correct numbers in the blanks.

1. Pest
2. Pesticide
3. Fungicide
4. Insecticide
5. Fumigation
6. Pathogen
7. Relative humidity
8. Moisture content
9. Perishable
10. Aeration
11. Spontaneous combustion
12. Crop preservation
13. Germination
14. Germination capacity
15. Crib

_____a. A structure with a roof and open sides for drying corn ears

_____b. Any living organism that damages crops or is annoying or destructive to humans in some way

_____c. The weight of water in a crop sample expressed as a percentage of the total weight of the sample

_____d. A pesticide used to kill fungi

_____e. The point at which a seed or plant vegetative reproductive organ having adequate moisture, temperature, and oxygen begins to grow

_____f. Something liable to spoil or deteriorate quickly, such as food with high moisture content

_____g. The process of using chemicals in a gaseous form in order to kill pathogens or insect pests

_____h. The process of ignition and burning as a result of heat generated by internal chemical action

_____i. The ratio, expressed as a percentage, of the quantity of water vapor actually present in the air to the greatest amount it could contain at that temperature

_____j. Any substance used to kill insects, rodents, weeds, or other pests

TEST

_____k. The percentage of seeds or plant vegetative reproductive organs capable of germinating to produce seedlings robust enough to establish in good field conditions

_____l. Process of moving small amounts of air through the stored crop at low flow rates to remove moisture and/or to cool the crop, and thus prevent deterioration of crop quality

_____m. Disease-causing microscopic organisms

_____n. A chemical or other substance used to kill or control populations of insects and related animals

_____o. Retardation of physiological processes in plant tissues to present a finished product in an attractive or usable form

2. List three causes of deterioration in storage.

a. ____

b. ____

c. ____

3. Select from the following list methods of postharvest preservation of crops. Write an "X" in the blank before each correct answer.

_____a. Processing with salt

_____b. Canning

_____c. Processing with sugar

_____d. Control of relative humidity

_____e. Drying

_____f. Refrigeration

_____g. Control of temperature

_____h. Control of oxygen and carbon dioxide levels

_____i. Vacuum storage

_____j. Quick freezing

TEST

4. Select from the following list advantages of proper crop storage. Write an "X" in the blank before each correct answer.

_____a. Increased crop loss

_____b. Decreased longevity of crop

_____c. Maintenance of crop quality

_____d. Marketing advantage

_____e. Holding of crop until ready for use

5. Name three types of crop storage.

a. ____

b. ____

c. ____

6. List two reasons farm storage is needed.

a. ____

____

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b. ____

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7. Name five kinds of grain storage facilities.

a. ____

b. ____

c. ____

d. ____

e. ____

TEST

8. Discuss the functions of harvesting machines.

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9. Select from the following list factors affecting crop storability. Write an "X" in the blank before each correct answer.

_____a. Maturity of crop at harvest

_____b. Temperature

_____c. Handling of crop

_____d. Length of storage

_____e. Crop variety

_____f. Moisture level

10. Select from the following list conditions of a safe storage facility. Write an "X" in the blank before each correct answer.

_____a. Maintain quality and quantity of crop

_____b. Protect against price fluctuations

_____c. Guard against unauthorized distribution

_____d. Guard against contamination

_____e. Protect from pests

_____f. Protect from moisture

TEST

11. Select from the following list factors which affect length of storage time. Write an "X" in the blank before each correct answer.

_____a. Cash needs of the farmer

_____b. Conditions of storage

_____c. Condition and quality of the crop

_____d. Kind of crop being stored

_____e. Availability of storage facilities

_____f. Current price and demand for crop

12. List two basic rules for storing seed.

a. ______________________________

b. ______________________________

13. List three ways of packaging seed for storage.

a. ______________________________

b. ______________________________

c. ______________________________

14. Discuss the control of insects in storage.

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TEST

15. List three seed treatments used in disease control.

a. ____________________

b. ____________________

c. ____________________

16. Discuss the control of rodents and birds in storage.

17. List two crops stored for relatively short periods.

a. ____________________

b. ____________________

18. List two crops stored for relatively long periods.

a. ____________________

b. ____________________

TEST

19. Select from the following list factors to consider in planning storage facilities. Write an "X" in the blank before each correct answer.

_____a. Preservation of crop quality

_____b. Control of light

_____c. Pest management

_____d. Temperature and moisture control

_____e. Convenience of storing and removal of crops

_____f. Proper size for current and future needs

20. Discuss measures to prevent suffocation in grain.

CROP STORAGE
UNIT 23

ANSWERS TO TEST

1. a. 15
   b. 1
   c. 8
   d. 3
   e. 13
   f. 9
   g. 5
   h. 11
   i. 7
   j. 2
   k. 14
   l. 10
   m. 6
   n. 4
   o. 12

2. a. Physical
   b. Chemical
   c. Biological

3. a, b, c, d, e, f, g, h, i, j

4. c, d, e

5. a. On-farm storage
   b. Cooperative
   c. Custom storage

6. Evaluated to satisfaction of instructor

7. Answer should include any five of the following

   a. On the ground
   b. Underground
   c. Bagged and stored in buildings
   d. Farm bins
   e. Bin sites
   f. Country elevators
   g. Terminal elevators

8. Evaluated to satisfaction of instructor

9. a, b, c, d, e, f

10. a, c, d, e, f

11. a, b, c, d, e, f

12. a. Store seed dry
    b. Keep seed dry

13. Answer should include any three of the following

    a. Bulk
    b. Burlap bags
    c. Cotton bags
    d. Paper bags and packets
    e. Cardboard boxes
    f. Cardboard drums

ANSWERS TO TEST

14. Evaluated to satisfaction of instructor

15. a. Mechanical treatment
    b. Physical treatment
    c. Chemical treatment

16. Evaluated to satisfaction of instructor

17. a. Fresh fruits
    b. Vegetables

18. a. Cereal grains
    b. Dried forage crops

19. a, b, c, d, e, f

20. Evaluated to satisfaction of instructor

CROP MARKETING AND EXPORTING
UNIT 24

UNIT OBJECTIVE

After completing this unit, the student should be able to match terms to the correct definitions, and distinguish between supply and demand as related to the crop marketing industry. The student should be able to select from a list factors affecting grades of commodities, and list sources of crop market information. This knowledge will be shown by completing the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with crop marketing and exporting to the correct definitions.
2. Distinguish between supply and demand.
3. Select from a list factors that distinguish between supply and demand curves.
4. Select from a list factors causing shifts in demand of a commodity.
5. Select from a list factors that affect the share which farmers receive on commodities.
6. Name three standard and grain acts that have affected the crops market.
7. Select from a list factors that influence time to market.
8. Select from a list sources for marketing crops.
9. Match the classes of elevators to the correct descriptions.
10. List five job opportunities in crop marketing.
11. List three functions of product standards.
12. Select from a list factors affecting grades of grain, hay, fruit and vegetables.
13. List four factors determining federal grades of grain.
14. Arrange in order the channel of marketing for grains, hay, fruit and vegetables.

OBJECTIVE SHEET

15. Match the steps of the marketing channel to the correct descriptions.

16. Discuss hedging as it relates to crop marketing.

17. Select from a list ways of using futures market.

18. Name three leading grain futures markets.

19. Select from a list sources of crop market information.

20. Select from a list major U.S. export crops.

21. Match the U.S. crop with the correct percentage of total production exported.

22. List five major countries importing U.S. commodities.

CROP MARKETING AND EXPORTING
UNIT 24

SUGGESTED ACTIVITIES

I. Suggested activities

  A. Order materials to supplement unit

    1. Literature

    2. Filmstrips, slideshows, etc.

    3. Films

  B. Make transparencies

  C. Provide students with objective sheet

  D. Provide students with information sheet

  E. Discuss unit and specific objectives

  F. Discuss information sheet

  G. Lead a discussion on how things would be without any of our modern marketing functions--in other words, without any "middlemen"

  H. Develop a class project around marketing some sort of product. Have students plan marketing strategies and discuss the factors that affected the success of the project

  I. Have students collect market reports and graph market trends

  J. Invite a broker who deals in the futures market to talk to the class

  K. Invite a progressive farmer to discuss marketing techniques with the class

  L. Visit a nearby grain elevator and discuss with the manager his buying and selling policies

SUGGESTED ACTIVITIES

- M. Give test
- N. Reteach if necessary
- O. Retest

II. Instructional materials

- A. Objective sheet
- B. Suggested activities
- C. Information sheet
- D. Test
- E. Answers to test

III. Unit references

- A. Agriculture III, Curriculum and Instructional Materials Center, Stillwater, Oklahoma.
- B. Basic Vo-Ag IV, Vocational Instructional Services, Texas A & M University.
- C. Carlile, R.B., and Stewart, B.R. Agribusiness. Instructional Materials Laboratory, Columbia, Missouri.
- D. Rush, M. and Foster, R. Farm Management. Department of Agricultural and Extension Education, Moscow, ID.
- E. Foreign Agricultural Trade Statistical Report, United States Department of Agriculture. Economic Research Service. Washington D.C., 1983.
- F. Kohls, R.L. and Uhl, J.N. Marketing of Agricultural Products. 6th edition. The Macmillan Company. New York, N.Y., 1985.

CROP MARKETING AND EXPORTING
UNIT 24

INFORMATION SHEET

I. Terms and definitions

A. Market--Place at which an exchange of commodities occurs between a buyer and a seller

B. Marketing--Activity involved in buying or selling a product

C. Cooperative marketing--Process whereby farmers pool their crops for shipment to market to increase bargaining power

D. Consumer--Final buyer and user of product

E. Forward contract--An agreement to sell a specified quantity of a product for a specified price and at a specified time in the future

F. Futures contract--A contract to deliver or accept delivery of a specified quantity and grade of a commodity at a specific future month

G. Futures market--An exchange where futures contracts for commodities are bought and sold

H. Contract--Promise to deliver or accept delivery of a specific grade of commodity at a specified time, place and price

I. Basis--Difference between the cash price and futures price

J. Commission--A fee given to an agent in exchange for a service, usually a service provided in selling a product

K. Hedge--A contract entered into for protection of an investment

L. Speculate--Attempt to make a profit by predicting what the market will do and buying or selling based on that prediction

M. Marketing margin--Difference between the amount consumers pay for the final product and the amount producers receive

N. Law of demand--Principle in economics which states that the quantity of an economic good purchased will vary inversely with its price

(Note: The lower the price is, the more goods will be purchased; conversely, the higher the price is, the less goods will be purchased.)

INFORMATION SHEET

O. Commodity--Agricultural product

P. Export--To send commodities from one country to another for purpose of sale

Q. Import--To bring commodities into one country from another

R. Tariff--A system of taxes placed by a government upon imports

II. Supply and demand

A. Demand--Schedule of different quantities of a commodity that buyers will purchase at different prices at a given time and place

(Note: One price is always associated with one quantity.)

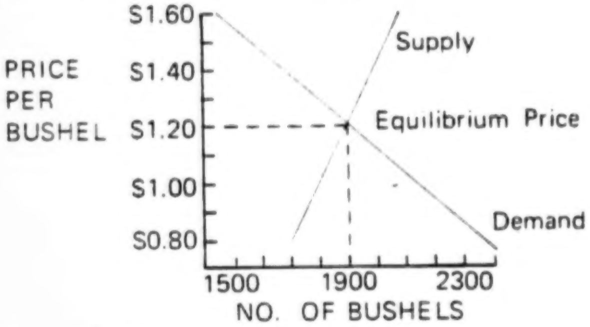
B. Supply--Schedule of different quantities of a commodity that will be offered for sale at different prices at a given time and place

(Note: One price is always associated with one quantity.)

III. Supply and demand curves

A. Demand curve always slopes downward

B. Supply curve always slopes upward



(Note: This is correct for an industry, e.g. wheat, etc. It is also correct for a firm which sells a perceptible portion of an industries output, e.g. G.M., etc. But, it is not correct for a firm whose sales do not affect the market price, e.g. a wheat farmer, etc. For that type of firm the demand curve in horizontal, meaning the quantity sold has no impact on the market price.)

INFORMATION SHEET

IV. Factors causing shifts in demand of a commodity

- A. Population increase or decrease
- B. Difference in income and purchasing power
- C. Changes in tastes and preferences of consumers
- D. Cost of product
- E. Expectations of buyers

V. Factors affecting farmers' share on commodities

- A. Processing

  Example: Cost of changing product form to satisfy the consumer

- B. Perishability

  Example: Spoilage is great; refrigeration is expensive

- C. Bulkiness

  Example: Products requiring large quanities of space for storage and/or transportation

- D. Seasonality of production

  Example: Quick market products

VI. Standard and grade acts that have affected the crops market

- A. Agricultural Marketing Act--Established in 1946 giving the Secretary of Agriculture power to develop and establish grades and standards for most farm commodities
- B. Grain Standards Act--Established in 1916 setting federal standards requiring all grain to be graded if sold through interstate commerce
- C. Standard Containers Act--Established in 1916 setting standards on the 2 quart, 4 quart, and 12 quart baskets
- D. Agricultural Adjustment Act--Established in 1933 for the purpose of organizing criterion for a fair price for agricultural products
- E. Pure Food and Drug Act--Established in 1906, expanded in 1938; designed to prevent shipment of adulterated or misbranded food and drugs

INFORMATION SHEET

VII. Factors influencing time to market

A. Price at harvest

B. Futures

C. Carry-over

D. Cost of storage

E. Storage facilities

F. Financial status of producer

G. Potential export

H. Projected national yield

VIII. Sources for marketing crops

A. Home farm use

(Note: Grains may be used for animal consumption on the farm or in a commercial feedlot. The grains also may be processed by local feed manufacturing plants.)

B. Local and/or terminal elevators

C. Direct to export

IX. Classes of elevators

A. Country

1. Independent--Elevator operated and controlled by individuals within the community

2. Cooperative--Elevator owned cooperatively by farmers of the area

3. Line--Elevator owned and operated by a central headquarters or chain

B. Terminal--Elevator operated by grain dealers or merchants who buy grain for storage and later sell to millers and processors or export

(Note: Because of the large storage capacity and investment powers, the terminal elevator operators/owners are able to utilize the futures market for hedging. The practice of buying and selling in futures is used by all elevator operators as they purchase grain.)

INFORMATION SHEET

X. Job opportunities in crop marketing

- A. Elevator operator or manager
- B. Elevator employee
- C. Seed grader or tester
- D. Broker
- E. Processing forman or manager
- F. Insurance representative
- G. Truck driver

XI. Functions of product standards

- A. Eliminate abuse in market
- B. Provide foundation for market system
- C. Protect farmer, buyer, and consumer

  (Note: Product standards facilitate marketing of products since the buyer does not actually have to see the product to know exactly what the product is like; standards also protect the consumer from getting substandard or inferior products.)

XII. Factors affecting grades of grain, hay, fruit and vegetables

- A. Grains
  1. Size of kernels
  2. Color of kernels
  3. Shape of kernels
  4. Free of decay
  5. Free of foreign material
  6. Free of insect damage
  7. Free of disease damage
  8. Maturity
  9. Moisture content
  10. Mechanical damage

INFORMATION SHEET

B. Hay

  1. Protein content
  2. Color
  3. Maturity
  4. Leafiness
  5. Texture

C. Fruits and vegetables

  1. Proper size
  2. Uniform, natural color
  3. Uniform shape
  4. Appearance (looks fresh and firm)
  5. Free of decay
  6. Free of sunscald
  7. Free of insect damage
  8. Free of disease damage
  9. Free of bruises
  10. Properly matured

XIII. Factors determining federal grades of grain

A. Test weight

B. Soundness of kernels

C. Cleanliness

D. Purity of type

E. Moisture content

F. Condition of grain

INFORMATION SHEET

XIV. Channel of marketing

A. Grains

1. Combine
2. Dryer
3. Elevator
4. Broker
5. Processor
6. Wholesaler
7. Consumer

B. Hay

1. Baler
2. Trucker-dealer
3. Storage
4. Feeder

(Note: This marketing channel does not always follow one certain pattern. In several areas of the state, hay is cut and placed in silos or converted directly into pellets for feeding purposes.)

C. Fruits and vegetables

1. Picker
2. Grader
3. Cleaner
4. Packager
5. Broker
6. Wholesaler
7. Retailer
8. Consumer

INFORMATION SHEET

XV. Steps of marketing channel

A. Assembling--Bringing together crops for shipment

B. Grading--Sorting the crop for uniform quality and size

C. Processing--Putting crop into usable form for consumer

D. Transporting--Moving the crop to market

E. Storing--Storing of crop for future use or until a higher price can be obtained

F. Financing--Loaning as a form of credit to a farmer until the crop can be sold or processed

G. Risk-taking--Assuming risk until the crop has been sold or processed

XVI. Hedging--The process of shifting the risk from prices which change in either direction

(Note: Hedging is distinct from speculation in commodity futures; the speculator seeks to make money from price changes; the hedger seeks to avoid losing money from adverse price change. Thus, the hedger minimizes price risk; the speculator assumes that risk. Confusion between hedging and speculation in commodity futures contracts is widespread. Some people think that losing money on the futures side of a hedge is a waste. Rather, it should be considered an insurance premium. The prupose of hedging is to break even, to avoid a loss, not to make money on the hedge.)

Example: Hedging using the cash and futures market

	Cash Market	Futures Market
On day of purchase	Purchase 50,000 bushels of wheat at $2.00 per bushel	Sold 50,000 bushels of wheat at $2.10 per bushel
On day of cash sale	Sold 50,000 bushels of wheat at $1.95 per bushel	Purchased 50,000 bushels of wheat at $2.05 per bushel
Result	The farmer lost 5¢ per bushel on cash market	However he gained 5¢ on the futures market

(Note: When cash grain was purchased, futures were sold. When cash grain was sold, futures were purchased. The cash market declined as he feared it might, and he lost 5 cents a bushel when he finally sold his grain. However, the futures market also fell, and there was a net gain of 5 cents a bushel on his futures transactions. This was a perfect hedge, since the loss on one market was exactly offset by the gain on the other.)

INFORMATION SHEET

XVII. Ways of using futures market

A. Price crop any time prior to harvest

B. Set price of product without taking immediate delivery

C. Fix price of grain in storage for deferred delivery

D. Speculation purposes

XVIII. Leading grain futures markets

A. Chicago

B. Minneapolis

C. Kansas City

XIX. Sources of crop market information

A. Radio and television stations

B. Newspapers

C. U.S. Department of Agriculture

D. Magazines

E. Local elevators or markets

F. Feed stores

G. U.S. Department of Commerce

XX. Major U.S. export crops (value, 1983)

A. Soybeans and soybean products--$7.8 billion

B. Corn and corn products--$6.3 billion

C. Wheat and wheat products--$6.2 billion

D. Tobacco and tobacco products--$2.5 billion

E. Cotton--$1.7 billion

INFORMATION SHEET

XXI. Amount of U.S. crop production exproted

Crop	Total Production	Total Exported	% of U.S. Exported	Year
Soybeans	2.277 bil. bu.	0.950 bil. bu.	42	82-83
Corn	8.397 bil. bu.	2.355 bil. bu.	28	81-82
Wheat	2.808 bil. bu.	1.600 bil. bu.	57	82-83
Tobacco	1.962 bil. lb.	0.550 bil. bu.	28	1982
Cotton	12 mil. bales	5 mil. bales	42	81-82
Grain Sorghum	879 mil. bu.	249 mil. bu.	28	81-82
Barley	479 mil. bu.	100 mil. bu.	21	81-82

XXII. Major countries importing U.S. commodities (value, 1983)

A. Japan--$5.9 billion

B. Netherlands--$2.8 billion

C. Canada--$1.9 billion

D. Mexico--$1.8 billion

E. South Korea--$1.7 billion

F. West Germany--$1.5 billion

G. Taiwan--$1.2 billion

H. Spain--$1.1 billion

I. USSR--$1.0 billion

J. Egypt--$0.9 billion

CROP MARKETING AND EXPORTING
UNIT 24

TEST

NAME____ SCORE_______________

1. Match terms associated with crop marketing and exporting to the correct definitions. Write the correct numbers in the blanks.

1. Market
2. Marketing
3. Cooperative marketing
4. Consumer
5. Forward contract
6. Futures contract
7. Futures market
8. Contract
9. Basis
10. Commission
11. Hedge
12. Speculate
13. Marketing margin
14. Law of demand
15. Commodity
16. Export
17. Import
18. Tariff

_____a. Activity involved in buying or selling a product

_____b. Final buyer or user of product

_____c. Difference between cash price and futures price

_____d. To bring commodities into one country from another

_____e. Promise to deliver or accept delivery of a specific grade of commodity at a specified time, place and price

_____f. Agricultural product

_____g. Place at which an exchange of commodities occurs between a buyer and a seller

_____h. A system of taxes placed by a government on imports

_____i. A contract entered into for protection of an investment

_____j. A contract to deliver or accept delivery of a specified quantity and grade of a commodity

_____k. Difference between the amount consumers pay for the final product and the amount producers receive

_____l. To send commodities from one country to another for purpose of sale

_____m. Principle in economics which states that the quantity of an economic good purchased will vary inversely with its price

TEST

_____n. An agreement to sell a specified quantity of a product for a specified price and at a specified time in the future

_____o. An exchange where futures contracts for commodities are bought and sold

_____p. Attempt to make a profit by predicting what the market will do and buying or selling based on that prediction

_____q. Process whereby farmers pool their crops for shipment to market to increase bargaining power

_____r. A fee given to an agent in exchange for a service, usually a service provided in selling a product

2. Distinguish between supply (S) and demand (D) by placing the correct letters in the blanks provided.

_____a. Schedule of different quantities of a commodity that buyers will purchase at different prices at a given time and place

_____b. Schedule of different quantities of a commodity that will be offered for sale at different prices at a given time and place

3. Select from the following list factors that distinguish between supply and demand curves. Write an "X" in the blank before each correct answer.

_____a. Demand curve always slopes upward

_____b. Supply curve always slopes upward

_____c. Demand curve always slopes downward

_____d. Supply curve always slopes downward

4. Select from the following list factors causing shifts in demand of a commodity. Write an "X" in the blank before each correct answer.

_____a. Expectations of sellers

_____b. Cost of product

_____c. Population increase or decrease

_____d. Expectations of buyers

_____e. Changes in taste and preferences of consumers

_____f. Difference in income and purchasing power

TEST

5. Select from the following list factors that affect the share which farmers receive on commodities. Write an "X" in the blank before each correct answer.

_____a. Processing

_____b. Bulkiness

_____c. Extreme seasonability of production

_____d. Perishability

6. Name three standard and grain acts that have affected the crops market.

a.____

b.____

c.____

7. Select from the following list factors that influence time to market. Write an "X" in the blank before each correct answer.

_____a. Price at harvest time

_____b. Futures

_____c. Price at planting time

_____d. Cost of storage

_____e. Cost of fertilizer

_____f. Carry-over

_____g. Storage facilities

_____h. Shipping cost

8. Select from the following list sources for marketing crops. Write an "X" in the blank before each correct answer.

_____a. Direct to export

_____b. Home farm use

_____c. Local and/or terminal elevators

TEST

9. Match the classes of elevators to the correct descriptions. Write the correct numbers in the blanks.

1.	Terminal	3.	Cooperative
2.	Independent	4.	Line

_____a. Elevator operated by grain dealers or merchants who buy grains for storage and later sell to millers and processors or exports

_____b. Elevator operated and owned from a central headquarters or chain

_____c. Elevator owned cooperatively by farmers of the area

_____d. Elevator operated and controlled by individuals within the community

10. List five job opportunities in crop marketing.

a.______________________________

b.______________________________

c.______________________________

d.______________________________

e.______________________________

11. List three functions of product standards.

a.______________________________

b.______________________________

c.______________________________

12. Select from the following lists factors affecting grades of grain, hay, fruit and vegetables.

I. Grain

_____a. Maturity at harvest

_____b. Moisture content

_____c. Bruises

_____d. Pest damage

_____e. Presence of foreign material

_____f. Size, color, and shape of kernels

TEST

II. Hay

_____a. Size and shape

_____b. Color

_____c. Protein content

_____d. Sunscald

_____e. Leafiness

_____f. Maturity at harvest

III. Fruits and vegetables

_____a. Proper size and shape

_____b. Uniform, natural color

_____c. Protein content

_____d. Bruises

_____e. Leafiness

_____f. Sunscald

13. List four factors determining federal grades of grain.

a.____

b.____

c.____

d.____

TEST

14. Arrange in order the channel of marketing for grains, hay, fruit and vegetables. Write a "1" before the first step, a "2" before the second step, and so on.

1. Assembling	5. Stroing
2. Grading	6. Financing
3. Processing	7. Risk-taking
4. Transporting	

_____a. Putting crop into usable form for consumer

_____b. Storing of crop for future use or until a higher price can be obtained

_____c. Moving the crop to market

_____d. Bringing together crops for shipment

_____e. Sorting the crop for uniform quality and size

_____f. Assuming risk until the crop has been sold or processed

_____g. Loaning as a form of credit to a farmer until the crop can be sold or processed

16. Discuss hedging as it relates to crop marketing.

TEST

17. Select from the following list ways of using the futures market. Write an "X" in the blank before each correct answer.

_____a. Speculate

_____b. Set price of product without taking immediate delivery

_____c. Fix price of grain in storage for deferred delivery

_____d. Increase sales

_____e. Price crop any time prior to harvest

_____f. Decide how many areas to plant

18. Name three leading grain futures markets.

a.____

b.____

c.____

19. Select from the following list sources of crop market information. Write an "X" in the blank before each correct answer.

_____a. Radio and television stations

_____b. Newsweek

_____c. Local elevators or markets

_____d. Magazines

_____e. County extension departments

_____f. Newspapers

_____g. Feed stores

TEST

20. Select from the following list major U.S. export crops. Write an "X" in the blank before each correct answer.

_____a. Potatoes

_____b. Cotton

_____c. Tobacco

_____d. Dry beans

_____e. Soybeans

_____f. Wheat

_____g. Barley

_____h. Corn

_____i. Apples

_____j. Rice

21. Match the U.S. crop with the correct percentage of total production exported. Write the correct numbers in the blanks.

1. 57%
2. 42%
3. 28%
4. 21%

_____a. Soybeans

_____b. Corn

_____c. Wheat

_____d. Tobacco

_____e. Cotton

_____f. Grain sorghum

_____g. Barley

22. List five major countries importing U.S. commodities.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ____________________ ____________

CROP MARKETING AND EXPORTING
UNIT 24

ANSWERS TO TEST

1. a. 2
   b. 4
   c. 9
   d. 17
   e. 8
   f. 15
   g. 1
   h. 18
   i. 11
   j. 6
   k. 13
   l. 16
   m. 14
   n. 5
   o. 7
   p. 12
   q. 3
   r. 10

2. a. D b. S

3. b, c

4. b, c, d, e, f

5. a, b, c, d

6. Answer should include any three of the following

   a. Agricultural Marketing Act
   b. Grain Standards Act
   c. Standard Containers Act
   d. Agricultural Adjustment Act
   e. Pure Food and Drug Act

7. a, b, d, f, g

8. a, b, c

9. a. 1 b. 4 c. 3 d. 2

10. Answer should include any five of the following

    a. Elevator operator or manager
    b. Elevator employee
    c. Seed grader or tester
    d. Broker
    e. Processing foreman
    f. Insurance representative
    g. Truck driver

11. a. Eliminate abuse in market
    b. Provide foundation for market system
    c. Protect farmer, buyer, and consumer

12. A. a, b, d, e, f
    B. b, c, e, f
    C. a, b, d, f

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ANSWERS TO TEST

13. Answer should include any four of the following.

    A. Text weight
    B. Soundness of kernels
    C. Cleanliness
    D. Purity of type
    E. Moisture content
    F. Condition of grain

14. I. a. 3
    b. 7
    c. 1
    d. 4
    e. 6
    f. 2
    g. 5

    II. a. 2
    b. 4
    c. 1
    d. 3

    III. a. 5
    b. 2
    c. 8
    d. 3
    e. 6
    f. 1
    g. 7
    h. 4

15. a. 3
    b. 5
    c. 4
    d. 1
    e. 2
    f. 7
    g. 6

16. Evaluated to satisfaction of instructor

17. a, b, c, e

18. a. Chicago
    b. Minneapolis
    c. Kansas City

19. a, c, d, f, g

20. b, c, e, f, h

21. a. 2
    b. 3
    c. 1
    d. 3
    e. 2
    f. 3
    g. 4

22. Answer should include any five of the following

    a. Japan
    b. Netherlands
    c. Canada
    d. Mexico
    e. South Korea
    f. West Germany
    g. Taiwan
    h. Spain
    i. USSR
    j. Egypt